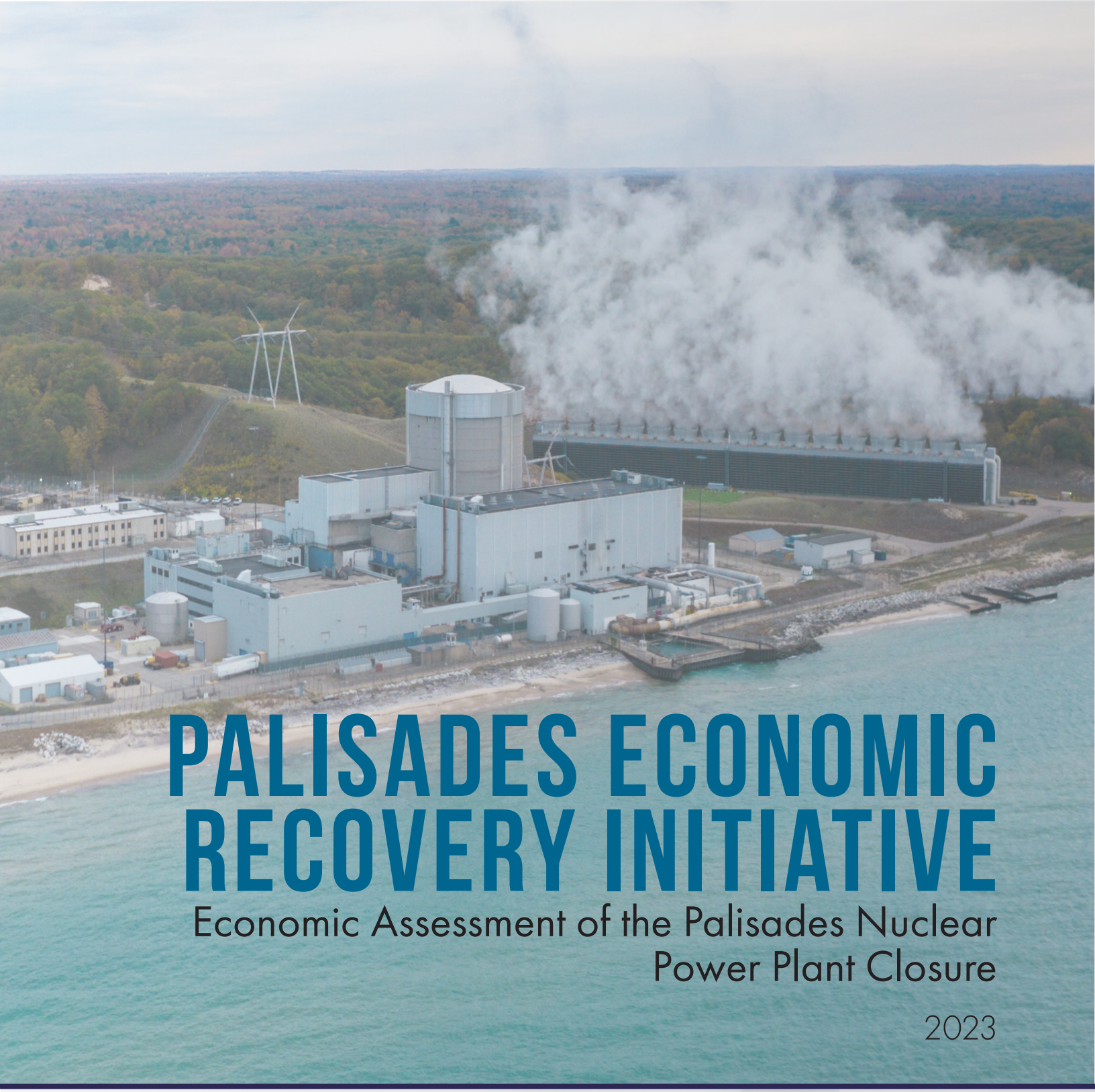

PALISADES ECONOMIC RECOVERY INITIATIVE

Economic Assessment of the Palisades Nuclear Power Plant Closure

2023

ECONOMIC GROWTH INSTITUTE
UNIVERSITY OF MICHIGAN

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The University of Michigan Economic Growth Institute (EGI) has provided innovative economic development programming and applied research for almost 40 years. The Economic Growth Institute works to build more resilient businesses and communities, connect university innovations with small and medium-sized enterprises, and provide student learning experiences for the next generation of community and business leaders.

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TEAM

Authors

Carmen Wells Quigg, Senior Project Manager, EGI
Sarah Crane PhD, Senior Research Manager, EGI
Lucia Farris, Research Project Manager, EGI
Sarah Fleckenstein, Graduate Research Associate, EGI
Kelly O'Laughlin, Graduate Research Associate, EGI
Carmen Wagner, Graduate Research Associate, EGI
Haley Neuenfeldt, Graduate Research Associate, EGI
Ryan Thyfault, Economic Analyst, Kinexus Group

Contributors

Greg Hardison, Graduate Research Associate, EGI
Lucas Eshuis, Graduate Research Associate, EGI
Saif Ur Rehman, Graduate Research Associate, EGI
Rishi Madethatt, Graduate Research Associate, EGI

Project Partners

SWMPC Southwest Michigan Planning Commission

kinexus group

ECONOMIC GROWTH INSTITUTE
UNIVERSITY OF MICHIGAN

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E·D·A
U.S. ECONOMIC DEVELOPMENT ADMINISTRATION

EXECUTIVE SUMMARY

The Palisades Nuclear Power Plant (PNPP), located in Covert Township, Van Buren County (VBC), Michigan, has generated electricity since 1971 through Consumers Energy and Entergy. In 2022, Entergy sold PNPP to the Holtec International subsidiary for decommissioning, which commenced on May 31, 2022. Prior to decommissioning, PNPP employed approximately 600 individuals and was a key source of tax revenue for the surrounding area. This study aims to identify the economic impacts of the PNPP closure on the surrounding area, including VBC, the Tri-County area of Van Buren, Berrien, and Cass, and the state of Michigan. IMPLAN modeling was used to identify industries impacted through employment and output loss, and interviews with local stakeholders were used to identify further impacts on the community and gather anecdotal stories of impacts. The Economic Modeling Specialist International (Emsi), now named Lightcast, was used to model labor and employment impacts as well as the industry purchasing. Based on these findings, potential strategies for mitigating adverse economic effects and planning were identified. This document presents five main parts: 1) Background; 2) Economic Modeling Analysis; 3) Assessment of Top Industries Impacted; 4) Other Important Considerations; and 5) Conclusion.

KEY TAKEAWAYS

The IMPLAN results indicated that the direct impacts of the closure on employment in VBC resulted in the loss of 334 jobs and over $13 million in output. The overall impacts (direct, indirect, and induced) in VBC include a loss of 549 jobs and over $193 million in output. The overall impacts in the Tri-County area included a loss of 739 jobs and over $259 million in output.

Based on IMPLAN modeling, the industries most impacted included employment services; food and beverage; retail; healthcare; electric power transmission and generation; other real estate; other local government enterprises; financial services; truck transportation and support activities; philanthropy; scientific research and development services; and consulting, management, and office support services. The impacts on local taxes, contract workers, transportation, and housing are also described. Additionally, the environmental impacts, safety requirements, and other implications were found to be notable and should be considered by local and state-wide stakeholders for future planning efforts.

From the results of analysis and assessment, the findings indicate that southwest Michigan has a distinctive labor economy characterized by an aging population and a declining number of young people that may pursue employment elsewhere. The closure of PNPP will likely negatively impact the Tri-County area by reducing the local tax revenue. Additionally, there will be a noticeable economic impact on businesses from the absence of contract employees during the non-peak tourism season.

These impacts could be mitigated by supporting job creation, healthcare capacity, and education provision and training in VBC, increased engagement between Holtec and the local community, increased attractiveness of the region for retention and attraction of residents, diversifying housing stock, expanding internet access, and strong environmental and safety monitoring.

TABLE OF CONTENTS

1 BACKGROUND 10

2 ECONOMIC MODELING ANALYSIS 16

3 ASSESSMENT OF TOP INDUSTRIES IMPACTED 26

4 OTHER IMPORTANT CONSIDERATIONS 58

5 CONCLUSION: KEY TAKEAWAYS & OPPORTUNITIES FOR MITIGATION 80

6 APPENDIX 100

7 RESOURCES 106

ACRONYM REFERENCE LIST

ACS	American Community Survey
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
CARES Act	Coronavirus Aid, Relief, and Economic Security Act
CNC	Civil Nuclear Credit
COVID	Coronavirus 19
CTE	Career and Technical Education
DECON	Decontamination: or immediate dismantling, occurs soon after the nuclear facility closes, and involves removal and decontamination of equipment, structures, and portions of the facility containing radioactive contaminants to a level that allows release of the property and termination of the NRC license
DOE	U.S. Department of Energy
EGI	University of Michigan Economic Growth Institute
EGLE	Michigan Department of Environment, Great Lakes, and Energy
EJ	Environmental Justice
Emsi	Economic Modeling Specialist International
EPA	U.S. Environmental Protection Agency
EPZs	Emergency Planning Zones
FEMA	U.S. Federal Emergency Management Agency
GDP	Gross Domestic Product
HOME	HOME Investment Partnership Program
IMPLAN	Impact Analysis for Planning : Economic model
IRA	Inflation Reduction Act
IRP	Integrated Resource Plan
ISFSI	Independent Spent Fuel Storage Installation
ISO	Independent Service Operator
LIHTC	Low-Income Housing Tax Credit
LLRW	Low Level Radioactive Waste
MiEJScreen	Michigan Environmental Justice Screening Tool
MISO	Midcontinent Independent System Operator
MUTs	Make and Use Tables
MW	Megawatt
MWh	Megawatt hours
NAICS	North American Industry Classification System
NATA	National-Scale Air Toxics Assessment

NGO	Non-governmental Organization
NRC	U.S. Nuclear Regulatory Commission
PCAP	Palisades Community Advisory Panel
PJM	Pennsylvania New Jersey Maryland Interconnection
PM	Particulate Matter
PNPP	Palisades Nuclear Power Plant
Q2	Quarter 2
RSEI	Risk-Screening Environmental Indicators
RTO	Regional Transmission Organization
SAFSTOR	Safe Storage: deferred dismantling, is when a nuclear facility is maintained and monitored in a condition that lets the radioactivity decay until the plant can be dismantled and decontaminated.
SD	Special District
SWMPC	Southwest Michigan Planning Commission
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TOPI	Taxes on Production and Income
TV	Taxable Value
UWSWM	United Way of Southwest Michigan
UWVBC	United Way of Van Buren County
VBISD	Van Buren Intermediate School District
VBC	Van Buren County
WCS	Waste Control Specialists

Source: PNPP Control Room, Photo by Joe Bissell, Accessed: July 12, 2023, https://www.mlive.com/public-interest/2023/04/palisades-nuclear-plant-may-land-up-to-300m-in-state-funds-for-restart-bid.html

PALISADES ECONOMIC RECOVERY INITIATIVE TIMELINE

PHASE 1: INITAL PLANNING

Phase 1 of the Palisades Economic Recovery Initiative focused on planning the research process, building the network and capacity, and engaging with the Palisades Advisory Committee (PCAP). The purpose of this phase is to establish the mechanism for research and community engagement.

- Planning process
- Build network and funding
- Engage Palisades Advisory Committee (PCAP)

SPRING 2021

PHASE 2: ANALYSIS & ASSESSMENT

Phase 2 of the Palisades Economic Recovery Initiative focused on initiating the research process. This comprehensive process uniquely combines quantiative analysis using IMPLAN input-output modeling; qualitative analysis derived from Lightcast; and input provided by community members, stakeholders, and collaboration with government agencies and local organizations. The purpose of this phase is for research and analysis to identify key areas affected by the power plant closure and document impacts into a written report. This report is to be distributed to the PCAP, community members, government organizations and other stakeholders.

- Project Launch
- IMPLAN Modeling
- Qualitative Research & Initial Mitigation Opportunities Research
- Share Results and Finalize Deliverables

SUMMER 2021 - SUMMER 2023

PHASE 3: MITIGATION STRATEGIES

Phase 3 of the Palisades Economy Recovery Initiative focuses on utilizing the results and mitigation strategies obtained in Phase 2 for planning and implementation. The purpose of this phase is to develop a strategic plan and retain a specialist who will execute indentified strategies aimed at mitigating the effects of the closure.

- Hire Specialist
- Develop Strategic Plan
- Implementation

SUMMER 2023 - SUMMER 2025

1 BACKGROUND

1.1 INTRODUCTION TO PALISADES NUCLEAR POWER PLANT

The PNPP, located in Covert Township, VBC, Michigan, is a nuclear power plant situated on the shores of Lake Michigan roughly five miles south of South Haven, Michigan. Constructed in the 1960s, the 432-acre facility came fully online in late 1971; since then, the facility has served as a regional hub of middle-to-high-skill employment for approximately 600 individuals.[1] PNPP has remained a key source of tax revenue for the surrounding area.[2] In addition to the facility's significant employment and tax footprints, it has been a boon to the local leisure and hospitality sector. While core to the local labor market and economy, the hospitality sector is subject to significant seasonal fluctuations in tourist inflow due to the region's propensity for inclement weather during the winter. PNPP served to mitigate this high degree of seasonality as off-season maintenance at the facility brought traveling workers to the area who would utilize local lodging, restaurants, and retail establishments during these down periods for regional tourism.

As PNPP is the only nuclear electric power generator in VBC, a Lightcast model was used to depict PNPP employment data using North American Industry Classification System (NAICS) codes. NAICS is the standard used by Federal statistical agencies in classifying entity establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. In 2020, the NAICS code associated with the "Nuclear Electric Power Generation" industry employed 645 total individuals at an average annual salary of $269,595 in VBC, accounting for 3.1% of total countywide employment that calendar year and leading all VBC industries for average earnings per job.[3] VBC's "Nuclear Electric Power Generation" industry had a location quotient of 117.85 in 2020, indicating that there were 1,685% more jobs in this industry than expected for a county of its size and demography, given national averages.

Source: PNPP Turbine Deck, Entergy

Source: PNPP Entrance Sign, Photo by Kelly O'Laughlin

1.2 DECOMISSIONING TIMELINE

The PNPP has been generating safe and reliable electricity since December 31, 1971. On April 11, 2007, Entergy completed the plant purchase from Consumers Energy for $380 million.[4] The purchase also included receipt of the used fuel at Consumers' decommissioned Big Rock Point Nuclear Power Plant, located in Charlevoix, Michigan.[5] In 2017, Entergy announced that it planned to close PNPP in the spring of 2022.[6]

In August 2018, after shutdowns and reactor de-fueling, Entergy announced it had agreed to sell the subsidiaries that own PNPP and the Pilgrim Nuclear Power Station in Plymouth, Massachusetts to a Holtec International subsidiary for prompt decommissioning.[7] The sales include the transfer of the licenses, spent fuel, and Nuclear Decommissioning Trusts, as well as the site of the decommissioned Big Rock Point Nuclear Power Plant near Charlevoix, where only the Independent Spent Fuel Storage Installation (ISFSI) remains.[8]

The plant shutdown started May 31, 2022, with fuel removal on June 20, 2022, and the official closure date on June 21, 2022.[9] Phase one of the site modifications started in June 2022 and will run through 2025. A historical assessment of the site began in June 2022 and will run through April 2023. ISFSI will also occur in different phases through 2025. There will be a complete dormancy period from 2026 to 2035. Phase two of site modifications will then take place through 2037. The characterization, ISFSI, segmentation, demolition, waste management, and site licensing will all take place following the dormancy period, with the former three lasting through 2040. Site restoration will take place in 2040 and 2041.

1.3 DEMOGRAPHIC OVERVIEW OF THE REGION

According to the 2019 5-Year American Community Survey, Berrien County had the largest population in the Tri-County area, which was followed by VBC and Cass County.[10] The Tri-County area had a majority White population. Berrien County displayed the most racial diversity, which is very consistent with the rest of the Michigan racial makeup.

Overall, the Tri-Counties had lower median household incomes than the Michigan average. Specifically, Berrien County had the lowest median household income and the highest percent of families that were below the poverty level. VBC had the highest percent of population 25 or older with a bachelor's degree or higher and a lower unemployment rate than Tri-Counties and Michigan. More information on demographics in these three countries can be found in Table 1.

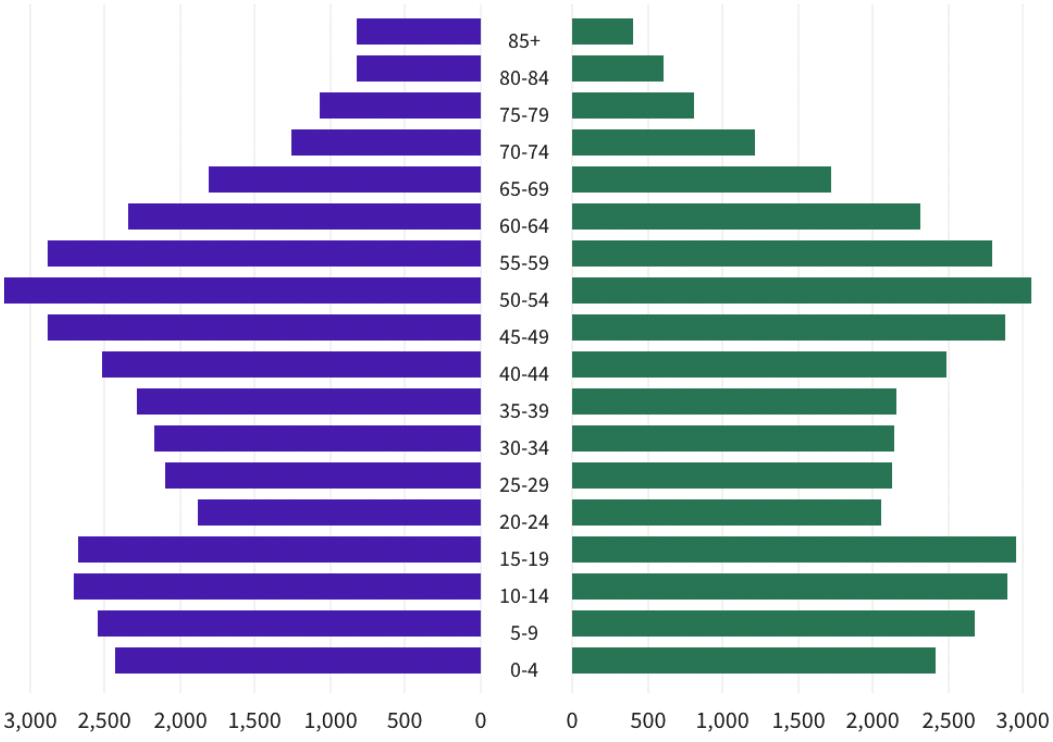
Table 1. Demographics of the Tri-County Area Compared to the State of Michigan in 2019[11]

	Michigan	Berrien County	Cass County	VBC
Total Population	9,965,265	154,133	51,523	75,358
Race				
White	78.4%	78.7%	88.9%	86.2%
Black	13.8%	14.6%	5.2%	3.3%
American Indian and Alaska Native	0.5%	0.4%	1.1%	1%
Asian	3.1%	1.9%	0.8%	0.7%
Some other race	1.2%	1.2%	1%	4.5%
Two or more races	2.9%	3.1%	3%	4.2%
Ethnicity				
Hispanic or Latino (of any race)	5.1%	5.5%	3.9%	11.5%
Not Hispanic or Latino	94.9%	94.5%	96.1%	88.5%
Additional				
Median Household Income	$57,144	$50,795	$55,107	$54,485
Unemployment Rate for ages 16+	5.90%	5.90%	6.40%	5.70%
Percent of Families Below Poverty Level	17.7%	16.7%	12.7%	14.3%
Bachelor's Degree or Higher for ages 25+	9.7%	7.6%	3.2%	9.6%

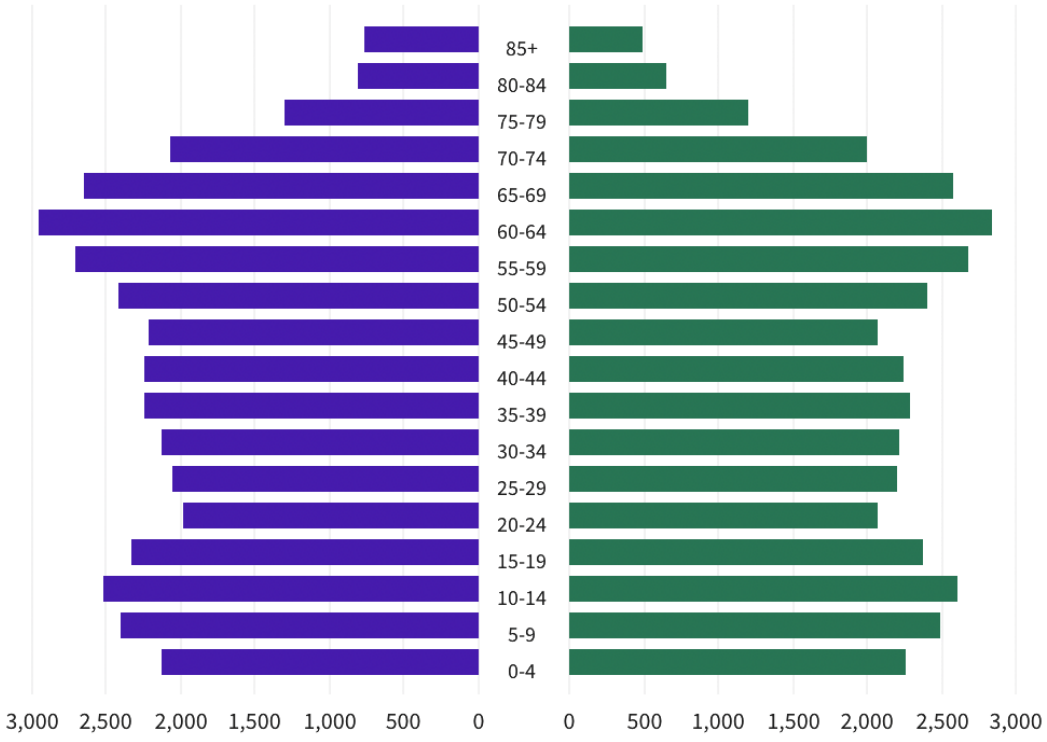
Source: Demographics Table, U.S. Census Bureau[12]

The population pyramid of Van Buren County in Figure 1.a displays an aging population with a young population that typically moves away around the age of 20. The population pyramid of VBC in 2010 is widest, and largest, in the age ranges of 50-60 and 10-19 years old. Comparatively, the 2021 VBC population pyramid age range in Figure 1.b shows the widest in the 60-70s, which displays an aging population that has stayed in VBC. However, the younger generation from the 2010 population pyramid showed a population decrease as they aged in 2021. This stark decrease of population between the ages of 15-19 and 20-24 in both the 2010 and 2021 population pyramids likely displays young adults moving away from home to college or jobs out of the area.

Figure 1. Population Pyramids for Van Buren County, MI in 2010 and 2021



(a)



(b)

Source: VBC Population Pyramids, USA Facts[13]
*Purple bars describe the number of females within the age group and the green bars describe the number of males within the age group.

2 ECONOMIC MODELING ANALYSIS

2.1 INTRODUCTION

The analysis of the economic impact of the PNPP decommissioning started with the economic impact software IMPLAN, with further validation of results through Emsi, labor market analytics.[14] These methods created a model of the economic impacts, which is the basis of research initiatives within the Economic Assessment research.

It should be noted that the IMPLAN model outputs do not include all the details and real-life experiences that have occurred or will occur due to the PNPP decommissioning. Therefore, the model was used to guide the initial research questions. Then, in the assessment section of this report, the IMPLAN model outputs were analyzed with other quantitative and qualitative data sources to assess the impact of the PNPP closure.

2.2 IMPLAN METHODOLOGY

2.2.1 ECONOMIC IMPACT ANALYSIS METHODOLOGY

The economic impacts of the PNPP decommissioning were estimated using the economic impact assessment software IMPLAN, with further validation of results through Emsi, labor market analytics. IMPLAN is based on Input-Output modeling, a type of applied economic analysis that tracks the interdependence among various producing and consuming industries. It measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands. IMPLAN uses annual, regional data to map buy-sell relationships to predict how specific economic changes will impact a given regional economy. In the case of the PNPP, it measures how the plant's closure ripples throughout the local economy. IMPLAN modeled impacts within VBC and the Tri-County region, which includes Van Buren, Berrien, and Cass Counties.

The model is designed to predict the ripple effects of a given economic activity in other industries and geographies through input purchases, labor payments, and trade. Production in a given sector in an economy supports the demand for production in sectors throughout the economy, both due to supply chain spending and worker spending. There are three defining effects given production in a particular economy, shown in Figure 2.

The first level of impact is the direct effects. The direct effect is the initial change in the final - industry output, employment, and labor income dollars. These are the initial effects of transitioning jobs in terms of lost income and output from those jobs. The second level of impact is indirect effects. Indirect effects are business-to-business purchases in the supply chain in the region, which stem from industry input purchases. The third level of impact is induced effects. The induced effects stem from labor income being spent throughout the region, originating from the direct and indirect effects.

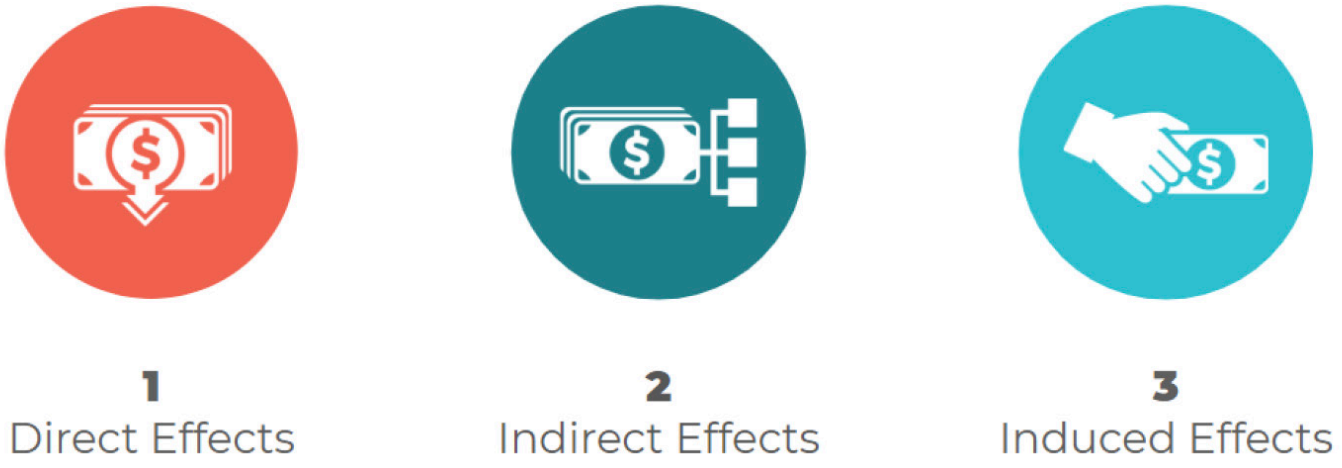
Data

The following data was provided by Entergy and was used to build the model: approximately 594 employees working at the PNPP as of Fall 2021, with wages equivalent to $70 million. Of the 594 employees working at the PNPP, only 260 were expected to remain to transition to Holtec in the summer of 2022.

Inputs

The fully loaded salary calculation is a necessary component of the model. Based on Bureau of Labor Statistics data for the region, it was estimated that there was an

Figure 2. Direct, Indirect, and Induced Effects



Source: Direct, Indirect, and Induced Effects, IMPLAN[15]

additional 30% in benefits and payroll taxes for the region. This data yielded a fully loaded payroll of approximately $91 million for the 594 employees. On average, this represented compensation per employee equivalent to $153,199. If 260 of the 594 employees transitioned to Holtec in the summer of 2022, then 334 employees would be fully transitioned out with the closure of the PNPP. The lost compensation tied to the 334 lost jobs was estimated by EGI at $51 million, given the fully loaded average compensation of employees at the PNPP described.

Modeling Economic Impacts

The model was run for the 2019 and 2020 data years, using 2022 dollars. The data year reflects which year IMPLAN pulls in data from sources such as the Bureau of Economic Analysis (BEA) and BLS datasets, as well as additional data from the U.S. Census Bureau, the Annual Survey of Governments, and the Annual Survey of Manufacturers. The latest dataset available in IMPLAN is for 2020. However, the U.S. and global economies experienced significant changes in 2020 associated with the Covid-19 pandemic. Therefore, 2020 IMPLAN data reflects many of these changes, and a large one-year shift may not reflect long-term trends for an industry. Since this may pose difficulties when running impact analyses, the model was run for both the 2019 and 2020 data years, and the economic impact results were averaged between the two years to generate a more accurate picture.

Modeling Industry Impacts

Regarding the top industries impacted by the PNPP closure, the results from the 2019 and 2020 IMPLAN datasets were also averaged, considering the direct, indirect, and induced effects on employment in each industry. The results were further validated by comparison with the results of top industries obtained from Emsi. Initial jobs in each industry in both the VBC and Tri-County regions were obtained for 2019 and 2020, and a percentage change was calculated based on the 2022 total impact.

2.2.2 ECONOMIC IMPACT ANALYSIS RESULTS

Two separate models of the PNPP closure were run, reflecting the economic impacts to VBC and separately within the Tri-County area, including Van Buren, Berrien, and Cass counties.

Van Buren County

VBC had a regional GDP of nearly $5 billion, with over 30,000 jobs in 2020. Table 2 shows the direct, indirect, induced, and total impacts for 2022 in VBC from the closure of the PNPP.

Table 2. 2022 Economic Impacts in VBC

	In 2022
Direct	
Employment	-334
Labor Income	-$51,166,462
Value Added	-$89,454,121
Output	-$166,202,547
Indirect	
Employment	-106
Labor Income	-$4,811,615
Value Added	-$6,288,219
Output	-$13,357,454
Induced	
Employment	-109
Labor Income	-$3,590,754
Value Added	-$7,222,898
Output	-$13,597,226
Total	
Employment	-549
Labor Income	-$59,568,831
Value Added	-$102,965,238
Output	-$193,157,227

Source: IMPLAN

Based on the data provided and modeling results from IMPLAN, a reduction in employment of 334 jobs, with a direct loss of labor income of approximately $51.2 million, correlated with a loss of total output of approximately $166 million for VBC. The nuclear industry's contribution to gross domestic product (GDP) in the region, without considering intermediate inputs, had an impact of approximately $89 million. The total impact, which considers direct, indirect, and induced effects, estimated a total of 549 jobs lost for the county. There was a reduction in the value added from the industry of approximately $103 million and a reduction in total output of $193 million. To put this in context, the total output in VBC was approximately $5 billion in 2020, so this impact represented about 3.9% of the VBC economy.

Source: "SouthHavenMichiganDowntown" By Dave Parker - Own Work. Licensed Under CC BY 3.0 Via Wikimedia Commons. Accessed: June 28, 2023, https://www.wmuk.org

Terms like "output" or "total output," refer to GDP, or the value of total production from the industry in the region. It consists of value-added and intermediate inputs, where value added is the contribution to GDP from the industry, taking away the cost spent on those inputs. Value added consists of labor income, "other" property income (which includes corporate profits or subsidies), and taxes on production and imports (such as any duties paid). Overall, the closure of PNPP resulted in 215 lost jobs across all industries. In terms of breaking

down the indirect and induced effects on the top industries affected, Table 3 shows 161 jobs lost across those industries most affected. The industries in Table 3 represent about 75% of the ripple effects in the economy. The remaining 25% was spread across numerous other industries with smaller impacts.

Of the sectors most affected, job loss in the employment services sector is at the top of the list with a loss of just over 34 jobs, representing a 7.03% decline in the industry. Employment services include employment placement agencies, executive placing consulting agencies, contract staffing services, etc. Restaurants, retail, and healthcare were the next most affected industries, with respective declines of 30.5, 27.9, and 12.5 jobs lost. In terms of the largest percentage declines by industry, the local government enterprises industry had the largest estimated decline, with a percent decline of 5.07%, after employment services. The local government enterprise industry refers to services by local governments that provide revenue, such as ports, parking lots, and airports.

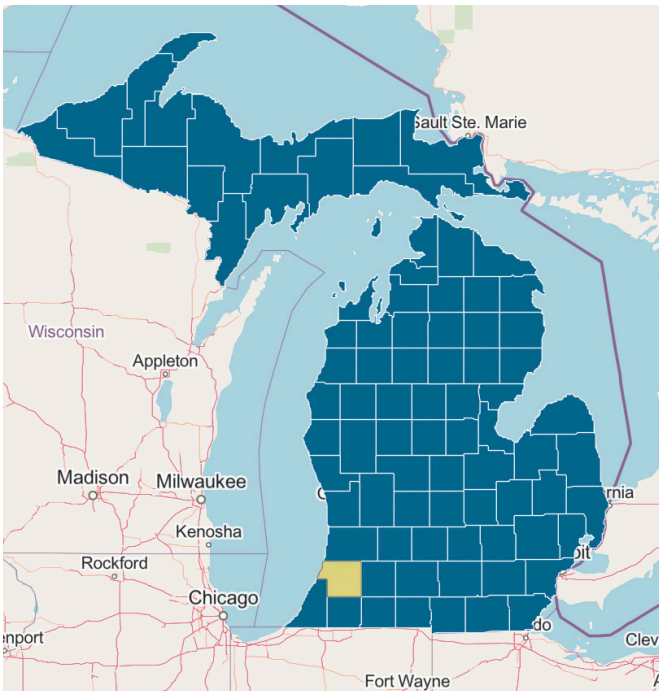


Figure 3. Van Buren County, MI
Source: Map by Sarah Fleckenstein, Van Buren County, MI

Table 3. *Top Industries Impacted in VBC*

Industry	Indirect	Induced	Total	% change
Employment services	-33.4	-1.4	-34.7	-7.03%
Restaurants	-11.5	-19.0	-30.5	-1.37%
Retail	-4.6	-23.3	-27.9	-0.98%
Healthcare	0.0	-12.5	-12.5	-0.76%
Other real estate	-7.1	-3.6	-10.6	-1.02%
Truck transportation & support activities	-8.4	-1.3	-9.6	-2.36%
Scientific research and development services	-7.6	-1.7	-9.2	-0.42%
Financial services	-4.0	-4.4	-8.4	-1.45%
Consulting, management, and office support services	-5.6	-1.9	-7.4	-0.76%
Philanthropic	-0.4	-7.0	-7.4	-1.22%
Other local government enterprises	-2.0	-0.3	-2.3	-5.07%

Source: IMPLAN

The Tri-County Region

The Tri-County region, consisting of Van Buren, Berrien, and Cass Counties, had a regional GDP of nearly $23 billion, with over 124,000 jobs in 2020. Table 4 shows the direct, indirect, induced, and total impacts for 2022 in the Tri-County region from the closure of the PNPP.

Based on the data provided and modeling results from IMPLAN, a reduction in employment of 334 jobs, with a direct loss of labor income of approximately $51.2 million, correlates with a loss of total output of approximately $180 million for the Tri-County region. The nuclear industry's contribution to GDP in the region, without considering intermediate inputs, had an impact of approximately $92 million. The total impact, which includes direct, indirect, and induced effects, had an estimate of 739 jobs lost for the region. There was a reduction in the value-added from the industry of approximately $131 million and a reduction in total output of $259 million. To put this in context, the total output in the Tri-County region was approximately $23 billion in 2020, so this impact represents about 1.1% of the Tri-County economy.

Overall, 406 jobs were lost across all industries from the closure of the PNPP. In terms of breaking down the indirect and induced effects on the top industries affected, Table 5 shows 298 jobs lost across those industries most affected. The industries in the table represent about 73% of the ripple effects in the economy. The remaining 27% was spread across numerous other industries with smaller impacts.

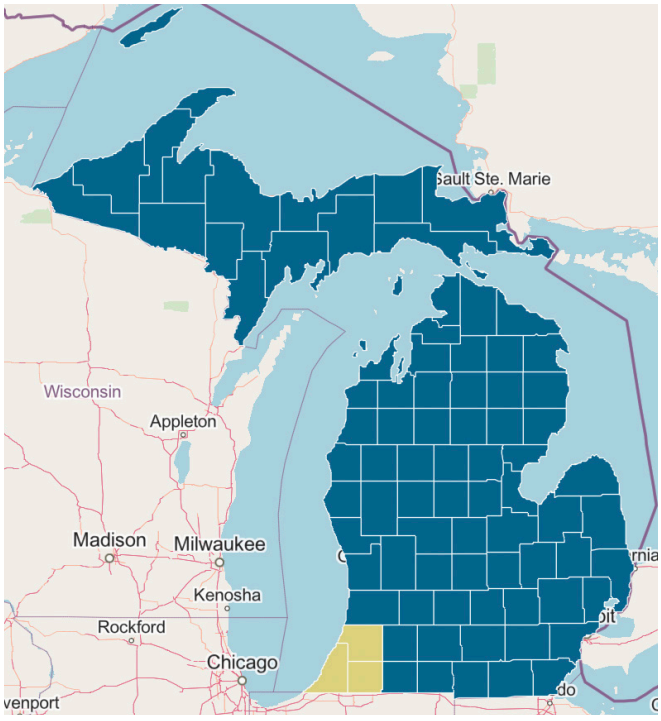


Figure 4. Tri-County Area, MI
Source: Map by Sarah Fleckenstein, Tri-County Area

Table 4. *2022 Economic Impacts in Tri-County Area*

	Total Impacts
Direct	
Employment	-334
Labor Income	-$51,166,462
Value Added	-$91,733,823
Output	-$180,124,823
Indirect	
Employment	-209
Labor Income	-$14,030,370
Value Added	-$24,916,373
Output	-$52,198,969
Induced	
Employment	-197
Labor Income	-$8,099,438
Value Added	-$14,742,361
Output	-$26,983,482
Total	
Employment	-739
Labor Income	-$73,296,270
Value Added	-$131,392,557
Output	-$259,307,274

Source: IMPLAN

The industries most impacted in the Tri-County area were in line with those found to be most impacted within VBC. For example, the jobs lost in the employment services sector topped the list with 61 jobs, representing a 1.89% decline in the industry. Restaurants, retail, and healthcare were the next most affected industries, with respective declines of 45, 40.7, and 32.3 jobs lost. Regarding the largest percentage declines by industry, electric power transmission and generation had the largest decline with a percent decline of 2.23%. This does not include the direct effects of the closure of the PNPP. Employment services had the next largest percentage decline, followed by truck transportation and support services, with a decline of 1.05%.

Table 5. Top Industries Impacted in Tri-County Area

Industry	Indirect	Induced	Total	% change
Employment services	-56.9	-4.2	-61.0	-1.89%
Restaurants	-14.8	-30.2	-45.0	-0.48%
Retail	-6.0	-34.8	-40.7	-0.36%
Healthcare	0.0	-32.3	-32.3	-0.35%
Electric power transmission & generation*	-19.5	-0.3	-19.7	-2.23%
Other real estate	-11.3	-7.3	-18.6	-0.40%
Other local government enterprises	-15.2	-2.5	-17.7	-0.90%
Financial services	-9.2	-8.1	-17.3	-0.55%
Truck transportation & support activities	-15.2	-1.9	-17.1	-1.05%
Philanthropic	0.0	-10.3	-10.3	-0.41%
Scientific research and development services	-7.3	-2.0	-9.3	-0.29%
Consulting, management and office support services	-7.5	-1.4	-9.0	-0.58%

*not including direct impacts from the PNPP
Source: IMPLAN

2.2.3 TAX IMPACTS

Modeling Tax Impacts

While the economic indicators were averaged for the 2019 and 2020 data years, tax impact results were only generated for the 2019 data year. Due to the large subsidies provided through the Coronavirus Aid, Relief, and Economic Security (CARES) Act in the second quarter of 2020, the ratio between federal Taxes On Production and Income (TOPI) and state/local TOPI is lower than normal. Therefore, when tax impacts were calculated for 2020, the federal government was given a smaller share of any TOPI impacts, and state or local governments were given a larger share. Therefore, only the 2019 data year is analyzed to convey a more accurate picture of typical tax impacts.

TOPI includes all payments to governments other than payroll and end-of-year income/profit taxes, for example, sales and excise taxes, customs duties, property taxes, motor vehicle licenses, severance taxes, and special assessments. However, this number does not include all taxes paid by industry since certain taxes are related to income/profits and are already reflected in the economic impacts of the model. For example, social insurance taxes are part of employee compensation, and profit taxes are part of other property income, reflected in the value-added components.

Tax Impacts Results for Van Buren

Table 6 shows the tax impacts from the closure of the PNPP in VBC, as well as impacts on the state and federal budgets. Sub-county general taxes refer to the impacts on cities or townships within the county, while sub-county special taxes refer to the impacts on the special districts such as police, fire, and schools. Table 6 reflects the tax impacts broken down into direct, indirect, and induced effects. The total numbers represent all three of those impacts on each category of taxes. The total negative tax impacts on all levels of government, including direct, indirect, and induced effects, from the closure of the PNPP are estimated at approximately $26 million. VBC specifically has a negative tax impact of approximately $1.4 million.

Tax Impacts Results for the Tri-County Area

Table 7 shows the tax impacts from the closure of the PNPP in the Tri-County region, as well as impacts to the state and federal budgets. The total tax impact number of approximately $35 million represents the impact at all levels of government from direct, indirect, and induced effects stemming from the plant's closure. The total negative impacts to county governments are estimated at $1.8 million, while city and township governments can expect a negative impact of approximately $2 million.

Table 6. 2019 Tax Impacts: VBC Regional Model

	Sub-county - General	Sub-county - Special	County	State	Federal	Total
Direct	-$1,488,487.06	-$4,108,164.62	-$1,268,021.82	-$5,836,204.11	-$10,235,158.13	-$22,936,035.73
Indirect	-$33,775.13	-$93,348.92	-$28,798.17	-$203,986.25	-$881,556.75	-$1,241,465.22
Induced	-$110,577.93	-$305,202.76	-$94,202.20	-$449,330.07	-$779,994.83	-$1,739,307.79
Total	-$1,632,840.11	-$4,506,716.30	-$1,391,022.18	-$6,489,520.43	-$11,896,709.71	-$25,916,808.74

Source: IMPLAN

Table 7. 2019 Tax Impacts: Tri-County Regional Model

	Sub-county - General	Sub-county Special	County	State	Federal	Total
Direct	-$1,631,900.26	-$3,889,913.88	-$1,451,232.22	-$7,731,300.36	-$11,226,376.81	-$25,930,723.53
Indirect	-$245,759.79	-$586,034.61	-$218,617.27	-$1,314,740.08	-$2,882,311.81	-$5,247,463.56
Induced	-$178,324.74	-$425,183.96	-$158,616.49	-$928,201.23	-$1,848,176.90	-$3,538,503.33
Total	-$2,055,984.79	-$4,901,132.45	-$1,828,465.98	-$9,974,241.67	-$15,956,865.53	-$34,716,690.42

Source: IMPLAN

2.3 LIGHTCAST INDUSTRY PURCHASING DATA: A HIGH-LEVEL OVERVIEW OF ECONOMIC IMPACTS

The industry purchasing data comes courtesy of Lightcast and represents annualized purchases for the year 2020, the last year of normal plant operations before the decommissioning process commenced. This data was produced via the proprietary Lightcast-type model, which, utilizing BEA Make and Use Tables (MUTs) as a basis, draws upon numerous data sources and the region's industry mix to generate regionalized industry purchase estimates from these base BEA MUTs.

Source: "Van Buren County Courthouse" by Charles W. Chapman - Own Work, Accessed: June 28, 2023, https://commons.wikimedia.org/wiki/File:Van_Buren_County_Courthouse_II.jpg

3 ASSESSMENT OF TOP INDUSTRIES IMPACTED

3.1 INTRODUCTION

The previous economic modeling analysis section outlined the modeled impacts from IMPLAN. The Assessment of Top Industries Impacted includes two sections: 1) Direct Economic Impacts and 2) Indirect and Induced Impacts. The direct impacts develop abruptly and locally, while indirect and induced impacts are more likely to be seen over longer periods and in wider geographic regions, with more gradual manifestations. However, these outcomes depend on the sector's resilience in addition to current and past impacts, such as demographic changes and COVID-19.

The researched sectors were determined by both the IMPLAN results and the directives of the EDA Nuclear Closure Communities program funding. The IMPLAN results guided the initial research topics and were compared to other data sources (some of which include: the Lightcast purchasing model, Census data, and informational interviews).

3.2 DIRECT ECONOMIC IMPACTS

3.2.1 LOSS OF TAX REVENUE: PLANT SITE PROPERTY TAX

General Tax Revenue

VBC has received an average of $19,961,589.60 each tax year in property taxes from 2017 to 2021. Table 8 describes the actual property tax revenue for each year from 2017 to 2022. Table 8 also includes the amount and percentage of the total property tax revenue that was contributed by the PNPP. Despite decreasing contributions from the PNPP,

Source: Covert Township, Photo by Kelly O'Laughlin

the Projected Budget Reports for Fiscal Years 2019-20, 2020-21, and 2021-2022 anticipated a 2.0-2.5% increase in overall property tax revenue.[16] Table 8 shows that total property tax revenue for the county has increased every year since 2017 while the property tax contribution from Entergy properties has decreased.

Palisades Nuclear Power Plant Properties

In 2021, there were six properties in VBC associated with the PNPP.[17] The assessed taxable value of these properties was $62.02 million.[18] The property taxable values are described in Table 9.

Governmental Entities that Levy Property Tax on PNPP Property

PNPP pays property tax levied by the State of Michigan, VBC, Covert Township, Covert Public Schools, Van Buren Intermediate School District, Lake Michigan Community College, and Van Buren District Library. In 2022, VBC levied millage for general government operations (4.4347 mills) and six millages earmarked for a specific purpose: ambulance services (0.9324 mills), public safety (.05332 mills), public transit (0.2458 mills), roads (0.9721 mills), conservation district (0.0991 mills), and veteran's relief (0.0995 mills). Table 10 shows the 2022 millage rates on PNPP property and the property tax levied in 2017-2022.

These millage rates are multiplied by the property's taxable value to determine the property tax owed. The property's taxable value equals 50% of its true cash value, except that its annual increase excluding new construction is limited to 5% or the rate of inflation, whichever is less. The property tax revenue has decreased by over 87% since 2017.

Table 8. *Tax Revenue*

Fiscal Year	Total Property Tax Revenue for VBC	Entergy Tax Contribution to VBC	Percentage Contributed by Entergy
2017	$19,076,246[19]	$8,985,883.76	47.1%
2018	$19,265,585[20]	$8,464,997.76	43.9%
2019	$19,556,203[21]	$3,935,374.21	20.1%
2020	$20,599,411[22]	$2,373,800	11.5%
2021	$21,310,503[23]	$1,423,680	6.7%
2022	$22,243,891[24]	$569,472	2.7%

Source: Tax Revenue, Format by Haley Neuenfeldt from Board of Commissioners. FY 2017-2022 Van Buren County Report on Financial Statements.

Table 9. 2023 *Taxable Value for PNPP*

Real Property	$7.3 million
Turbine personal property (subject to 18 SD* operating mills)	$12.0 million
Subtotal: Taxable Value (TV) subject to 18 mills	$19.3 million
TV multiplied by 18 mills	$347,400
Non-turbine industrial personal property (exempt from 18 mills)	$8.0 million

* Special District "Covert Township School District"

Source: Taxable Value for PNPP, Format by Sarah Fleckenstein from Covert Township, Office of the Assessor.

Table 10. Government Entities that Levy Property Tax on PNPP Property and Revenue

		Palisades Property Tax Liability					
Tax	**2022 Millage Rate**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
VBC Allocated	4.4347	$1,054,316.58	$953,587.62	$738,339.18	$434,671.81	$276,416.16	$120,587.03
VBC Roads	0.9721	$230,304.98	$208,301.74	$161,282.86	$95,281.36	$60,591.25	$26,433.05
VBC Ambulance	0.9324	$221,670.03	$200,491.76	$155,235.79	$91,389.73	$58,116.49	$25,353.54
VBC Police	0.5332	$126,141.36	$114,089.87	$88,336.95	$52,005.34	$33,071.20	$14,498.61
VBC Transit/ Bus	0.2458	$58,457.48	$52,872.48	$40,937.85	$24,100.75	$15,326.13	$6,683.72
VBC Conservation	0.0991	$23,562.79	$21,311.61	$16,501.05	$9,714.43	$6,177.59	$2,694.70
VBC Veterans	0.0995	$-	$5,349.30	$4,141.83	$9,753.44	$6,202.40	$2,705.57
State Education Tax*	6	$1,202,476.80	$1,136,619.60	$542,675.40	$345,206.40	$222,144.00	$115,150.20
Covert School Non-Homestead Operating	18	$3,607,430.40	$3,409,858.80	$1,628,026.20	$1,035,619.20	$666,432.00	$345,450.60
LMCC Operating	2.2654	$535,935.19	$484,732.17	$375,316.07	$220,954.43	$140,509.17	$61,600.08
Covert Twp Allocated	0.8198	$193,943.53	$175,414.25	$135,818.89	$79,958.70	$50,847.28	$22,291.76
Covert Twp Roads	0.5	$117,435.43	$106,215.70	$82,836.60	$48,767.20	$31,012.00	$13,595.95
Covert Twp Fire/ Ambulance	1.7	$399,266.28	$361,120.54	$281,644.44	$165,808.48	$105,440.80	$46,225.89
Covert Twp Police	1.9	$446,249.91	$403,615.38	$314,779.08	$185,315.36	$117,845.60	$51,664.23
Covert Twp Water Bond	1.1735	$394,463.82	$219,941.82	$284,759.10	$136,577.42	$84,402.26	$31,909.46
Covert Twp Senior Services	1.0025	$58,717.72	$53,493.00	$41,418.30	$24,383.60	$15,506.00	$27,191.70
VB District Library	1.0831	$256,233.52	$231,753.07	$179,440.64	$105,639.51	$67,178.19	$29,451.33
VB ISD Operating	0.1407	$33,285.99	$30,105.86	$23,310.22	$13,723.09	$8,726.78	$3,806.84
VB ISD Special Education	4.1969	$784,882.22	$709,894.90	$549,653.98	$411,370.84	$261,598.62	$114,120.85
VB ISD Vocational Education	2.4763	$588,714.90	$532,469.32	$412,277.76	$242,714.35	$154,346.72	$67,334.81
Total		$10,333,488.94	$9,411,238.81	$6,056,732.18	$3,732,955.44	$2,381,890.63	$1,128,749.81

* Not levied on Non-Turbine industrial personal property

Source: Michigan Department of Treasury. "Form L-4029 by Van Buren County". 2022.

Covert School District

Covert School District was one of the primary beneficiaries of the tax revenue generated by the PNPP. The school district comprises Covert Elementary School, Covert Middle School, and Covert High School, which supported 346 students in the 2020-21 school year. 100% of the students fell under the economically disadvantaged category.[25]

Under Proposal A of 1994, the State of Michigan determined a new mechanism to allow for school districts that serve communities with a large number of students from low-income families to receive a more equitable distribution of state funding through the foundation allowance. The foundation allowance allocates per-pupil funds to school districts and comprises combined state and local funds.[26] The local revenue to this fund is generated from a tax on all "non-homestead property" in a district at a maximum rate of 18 mills.[27,28] The School Aid Fund supports any remaining revenue needed for the foundation allowance through state taxes such as the sales and income tax, the State Education Tax, lottery revenues, use tax, tobacco tax, and real estate transfer tax. School districts that levy enough revenue to fund their foundation allowance through property taxes would not receive additional funds from the School Aid Fund.[29]

In 2020-2021, Covert School District's Proposal A Foundation Allowance was $9,814 per pupil. Because its local revenue exceeded its foundation allowance, Covert School District received no money from the School Aid Fund but was allowed to keep its local revenue in excess of the foundation allowance.[30] Table 11 shows the Foundation Allowance amounts for Covert Public Schools.

Table 11. *Foundation Allowance Amounts for Covert Public Schools*

2020-21 Foundation Allowance Covert Public Schools (80040) per pupil[31]						
Year	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Covert Public Schools	$9,344	$9,454	$9,574	$9,694	$9,694	$9,814[32]

Source: Michigan School Data. "Foundation Allowance. Van Buren ISD. Covert Schools". https://www.mischooldata.org/foundation-allowance/

Van Buren Intermediate School District

Van Buren Intermediate School District (VBISD) could also be significantly impacted due to the decrease in property tax revenue from the decommissioning of the PNPP. The annual tax revenue impact of the closure on VBISD was approximately $318,390. It is unclear how funds may be reallocated, or millage rates will be adjusted to account for the decrease in property tax revenue.[33]

Conclusion

The PNPP was a large source of tax revenue for Covert Township, which will result in an overall revenue loss for the region. However, Entergy's early announcement of the PNPP closure in 2016 made it possible for the local government to prepare, adapt, and begin to compensate for the tax impact of the full closure of the plant. Since 2017, the percent of property tax revenue contributed by PNPP decreased significantly each year; however, the total property tax revenue for the county increased (see Table 8).

The tax revenue from the PNPP supports a large amount of the Covert Public Schools funding. Because it generates so much tax revenue, Covert is considered an "out-of-formula" district, meaning one whose local revenue exceeds their foundation allowance and receives no state increases. However, Covert's dependence on property taxes is a potential trigger for an economic collapse within the district. Covert Public Schools officials knew PNPP could potentially close in 2022. Therefore, leadership at the school district had time to prepare and officials have been conservative with their spending. These efforts helped to create a significant fund balance for the district.

While no government outside Covert Township received tax revenue or saw a direct loss, the effects will be widespread with the closure impacting many residents, families, and businesses throughout the region. These broad impacts have the potential to impact the tax revenue of other local governments. Additionally, PNPP was one of the largest employers and taxpayers in Covert Township, Van Buren County. In 2023 the property remained on the tax roll, and the full future tax impact or contribution will remain to be seen.

3.2.2 LOCAL COST OF PURCHASING ELECTRICITY

Background

In 2021, VBC was the 26th largest county in the state of Michigan with a population of 75,660 residents.[34] It ranked as the 5th highest electricity producer in the state out of 83 counties, generating a total of 14,336,761 megawatt hours (MWh) of energy, as shown in Table 12. The average number of electrical outages experienced by VBC citizens each year was 2.05, with an average duration of 274.3 minutes per incident. Additionally, VBC residents faced an average residential electricity bill of $145.48, which was 19.33% higher than the national average bill of $121.91.[35]

In 2023, total energy production decreased to 13,195,735 MWh, and VBC is no longer one of the top electricity producers in the state.[36] The average number of outages experienced by VBC citizens decreased to about 1.95 per year, with an average duration of 321.5 minutes per incident. The average monthly electricity bill for residents varied across different areas of southwest Michigan, ranging from $122.89 in Paw Paw to $155.47 in Mattawan, but remained lower than the average rate in Michigan.

Table 12. Energy consumption in Van Buren County 2021

Energy Consumption	
Total Consumption	750,410 MWh
Consumption per Capita	9.92 MWh
Energy Production	
Total Production	14,336,761 MWh
Production from Renewable Energy	4,907 MWh
Production from Non-Renewable Energy	14,331,854 MWh
Production per Capita	189.45 MWh

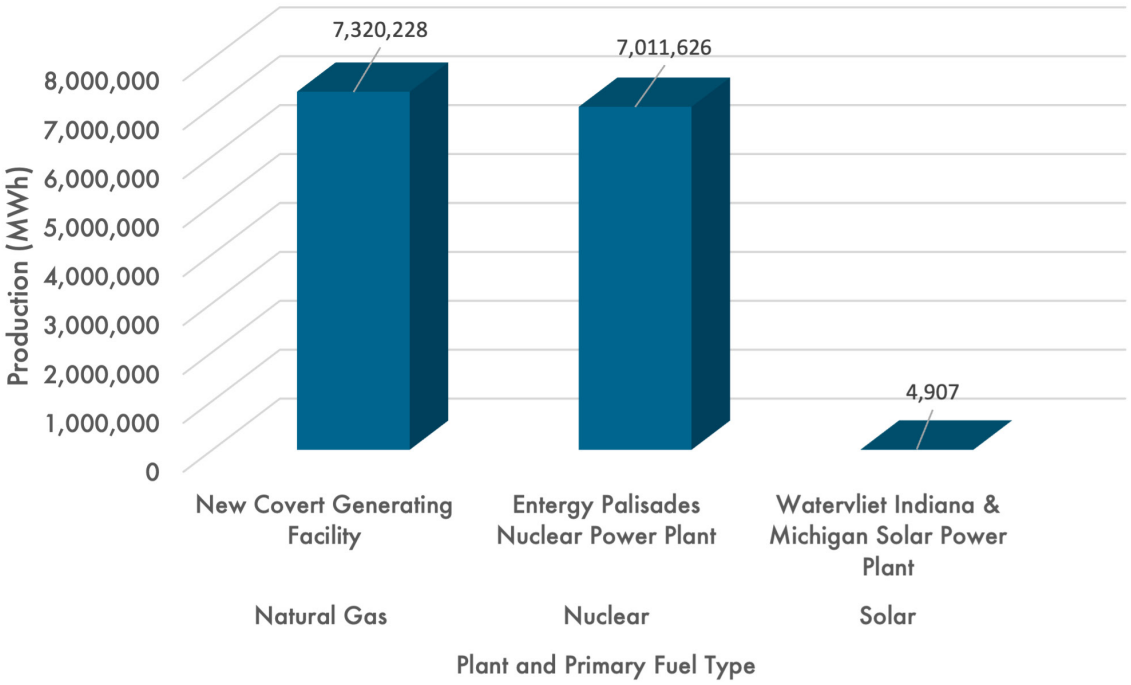
Source: King Manalo, Find Energy[37]

Table 13. Energy consumption in Van Buren County 2023

Energy Consumption	
Total Consumption	750,706 MWh
Consumption per Capita	9.94 MWh
Energy Production	
Total Production	13,195,7361 MWh
Production from Renewable Energy	0 MWh
Production from Non-Renewable Energy	13,195,7361 MWh
Production per Capita	174.66 MWh

Source: King Manalo, Find Energy[38]

Figure 5. Fuel Types in Van Buren County



Source: Fuel Types in VBC, Format by Sarah Fleckenstein from King Manalo, Find Energy[39]

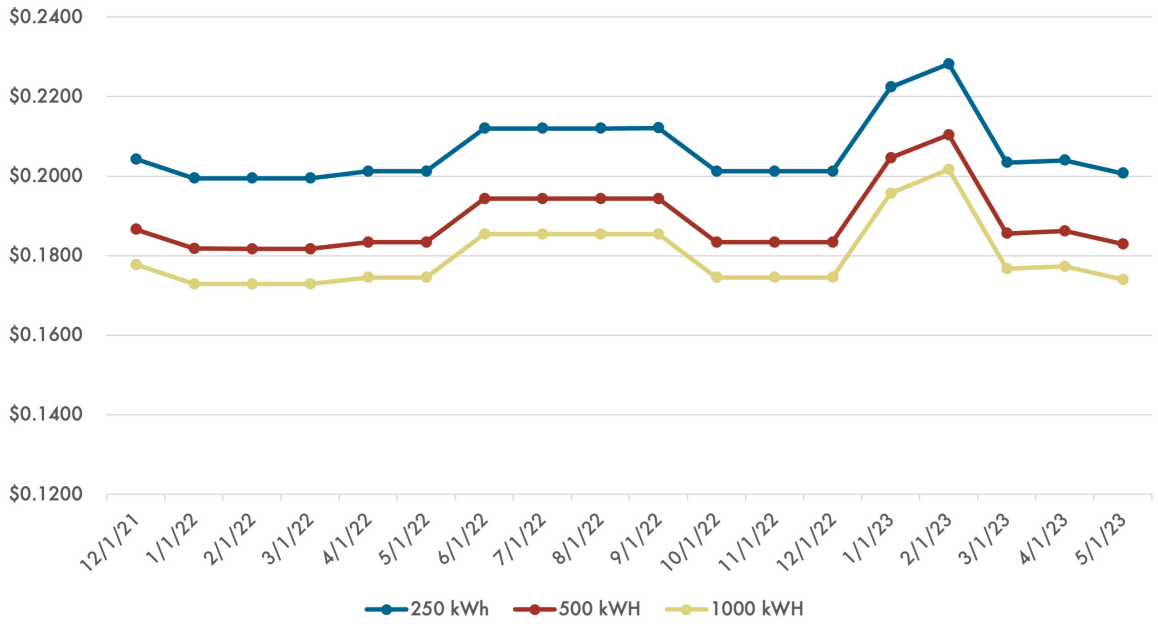
In 2021, VBC relied on three main fuel types for electricity generation: natural gas, nuclear, and solar. However, the energy produced from natural gas surpassed that of nuclear and solar as shown in Figure 5.

Michigan's transmission power grid is primarily managed and operated by Midcontinent Independent System Operator (MISO) interconnection. However, the transmission grid in southwest Michigan, including Van Buren, Berrien, and Cass counties, is operated by PJM (Pennsylvania-New Jersey-Maryland) Interconnection. Indiana Michigan Power is the main public electricity provider for the Tri-County area, although there are regional differences with some electric utilities provided by Consumer Energy. Gas utility service is split between SEMCo Energy Gas Co., Michigan Gas Utilities, and Consumers Energy.[40] PNPP, located in VBC, generated electricity that was transmitted by MISO, and Consumers Energy was the major public utility company utilizing the nuclear power generated. Additionally, several smaller electric utilities serve the region which includes Midwest Energy & Communication and several municipal electric utilities. Indiana Michigan Power is the electric utility for most customers in the Tri-County area.

Impact from Closure on Household Electricity Prices

The closure of PNPP, with a 805 megawatt (MW) capacity in MISO's total 154,000 MW portfolio (as of Spring 2023), raises concerns about potential increases in electricity prices for residential, commercial, and industrial consumers.[41] However, due to the relatively small percentage of PNPP's capacity in MISO's overall capacity, it is unlikely that the closure will have a significant impact on wholesale or residential prices for Consumer Energy Customers.[42] Additionally, due to regulatory processes, the wholesale and residential price changes were reflected in rates prior to the plant's closure.

Figure 6. Average Monthly Rate Per kWH for Consumers Energy



Source: Average Monthly Residential Rates for Consumers Energy, Format by Sarah Fleckenstein from Michigan Public Service Commission[44]

PJM is the predominant regional transmission organization (RTO) in the Tri-County area and the closure will likely have little to no impact on wholesale electricity prices for the Tri-County area's residents. Considering the complexity of the energy markets, there could be a small effect on wholesale electricity prices or MISO customers, as it would need to accommodate electricity demand from alternative sources for its customers. Nonetheless, household energy prices are not expected to rise significantly as a result of the closure, given the large energy market size and the relatively small household demand capacity.[43] Figures 6 and 7 illustrate household energy prices from December 2021 to May 2023 for both Consumers Energy and Indiana-Michigan Power. These figures encompass periods, before, during, and after the power plant closure. This reiterates the limited impact on householder energy prices due to the vast size of the energy market when compared to the demand of a single household.

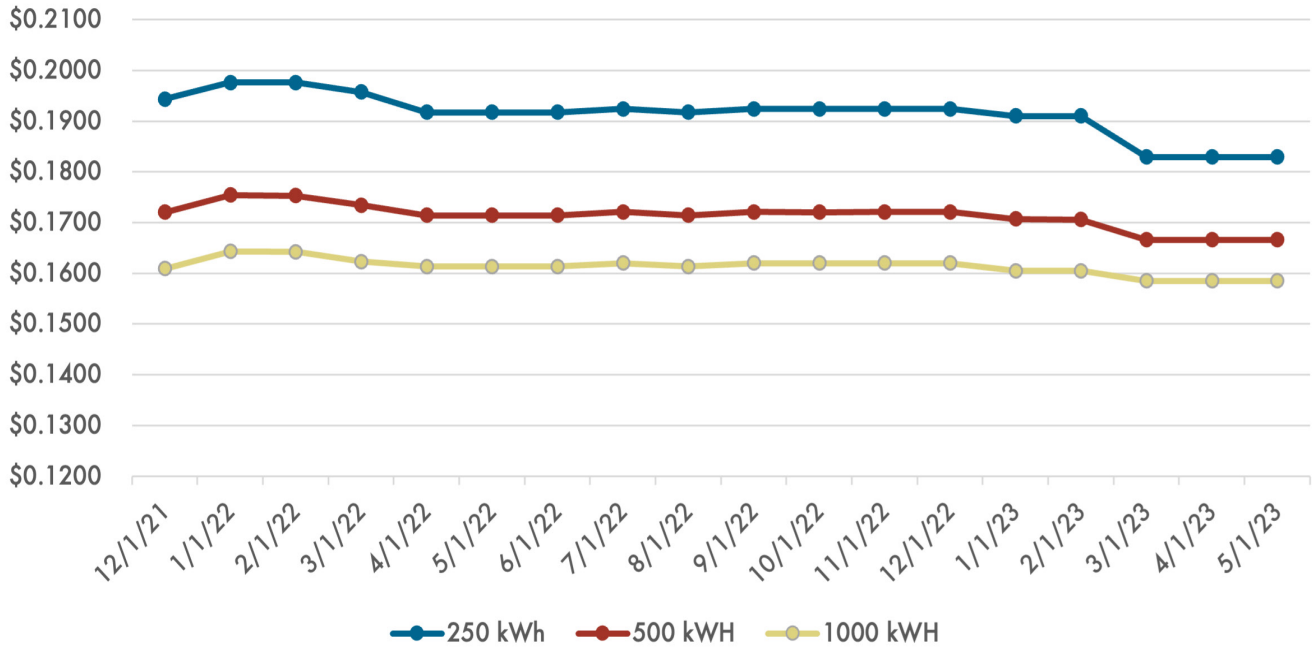
3.3 INDIRECT AND INDUCED ECONOMIC IMPACTS

Indirect effects are the effects stemming from business-to-business purchases in the supply chain taking place in the region.

Induced effects are the effects in the region stemming from household spending of labor income after the removal of taxes, savings, and commuters.

In describing the relative importance of each impacted industry to regional employment, earnings, and other relevant topics (e.g., economic development), annualized 2022 jobs and earnings data was used courtesy of Lightcast Data Set 2023. The year 2022 was used as it represents the first-year regional employment had stabilized post-pandemic. By using 2022 as an employment and earnings

Figure 7. Average Monthly Rate Per kWH for Indiana Michigan Power



Source: Average Monthly Residential Rates for AEP, Format by Sarah Fleckenstein from Michigan Public Service Commission[45]

benchmark, it also provides a more realistic window into secondary and tertiary job losses resulting from the plant's decommissioning by accounting for the delay that is inherent to indirect and induced economic impacts on employment in other industries. Within the Lightcast tables, "in-region purchases" refers to purchases only in VBC and "imported purchases" refer to purchases anywhere outside of VBC.

3.3.1 EMPLOYMENT SERVICES

Background

According to the North American Industry Classification System (NAICS), the employment services "industry group comprises establishments primarily engaged in one of the following:

1. listing employment vacancies and referring or placing applicants for employment;
2. providing executive search, recruitment, and placement services;
3. supplying workers to clients' businesses for limited periods to supplement the working force of the client; or
4. providing human resources and human resource management services to client businesses and households."[46]

In 2022, there were 144 and 1,965 total pay rolled jobs in this industry group in VBC and the Tri-County area, respectively.[47]

Examples of these businesses within the Tri-County area include Michigan Works!, the Michigan Workforce Development Institute, the Michigan Unemployment Office, and temp agencies. The majority of employment at PNPP was conducted through Entergy and is undertaken through Holtec currently.

The main challenges regarding the southwest Michigan workforce are attraction and retention. Outside of South Haven, the rest of VBC is very rural and remote, and there is a major lack of broadband internet access, especially compared to nearby cities in Michigan (such as Kalamazoo and Grand Rapids).[48] These challenges can make this area a less attractive community to live and work in compared to other nearby areas. This can make it difficult to attract workers and entrepreneurs in non-agricultural industries which limits long-term worker retention and disincentivizes young adults to stay in the area after they finish high school.

Indirect Impacts

According to the IMPLAN results, the loss of employees at PNPP will indirectly impact the employment services industry from the loss of 33 jobs in VBC and 57 jobs in the Tri-County area. The employment services industry will be impacted by the loss of jobs from the PNPP, as the services that help people in the nuclear industry find jobs in this area are less needed, such as employment search services and employment placement agencies. According to Table 14, the total impacted purchases from the PNPP in Quarter 2 (Q2) of 2022 in the employment services industry is $21,491,558.

The largest loss in revenue in Q2 comes from seasonal contract workers during outages at the plant. $16,048,008 in total purchases from PNPP to temporary help services will be lost quarterly, including mostly imported purchases and some in-region purchases. These contract workers come to the region and spend money on food, lodging, and other necessities or entertainment during the tourism off-season. Therefore, jobs and output in the employment services sector will be affected by decreased business output from less community spending and workforce supply.

Table 14. Employment Services Industry Purchases for PNPP in Q2

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
561320	Temporary Help Services	$1,692,223	$14,355,785	$16,048,008
561330	Professional Employer Organizations	$2,988,175	$765	$2,988,940
561311	Employment Placement Agencies	$0	$1,744,406	$1,744,406
561312	Executive Search Services	$150,675	$559,528	$710,204
Total		$4,831,073	$16,660,484	$21,491,558

Source: Lightcast Q2 2022 Data Set, Kinexus Group[49]

Induced Impacts

The PNPP decommissioning will likely create some major challenges in the employment services industry resulting in induced impacts in the region. The decommissioning of PNPP has and will lead to some highly paid people and their families leaving the community.[50] The induced impact would come from people leaving the community that previously would spend money in the area. Additionally, their families would have likely worked and their children would have gone to school in the area. Ideally, their children would also eventually make up some of the future/present workforces (if they were in high school).

When PNPP employees move away, the area will likely lose talent with specific skill sets. Additionally, there would be lost talent of the working family members as households move away post-closure. Former PNPP employees and families likely have the skill sets that would be opportune for opening new businesses and becoming entrepreneurs in the area if they decided to stay. One way to keep these people in the area would be to focus on making the community more attractive with new and small business incentives or community revitalization projects. A loss of a workforce of this magnitude also leads to less workforce supply.[51]

In general, nuclear plants create hundreds of jobs by themselves, and for every 100 nuclear power plant jobs, 66 more jobs are created in the local community.[52] The area will lose approximately 400 employees from the PNPP, which translates into around 264 more jobs in the local community that will be lost, according to this calculation. The IMPLAN results found similar results with 315 jobs lost in VBC and 306 jobs lost in the Tri-County area–all from indirect and induced impacts (Tables 2 and 4). This will impact employment service organizations that focus on recruiting, job searches, supplying contract workers, and supplying human resources, among others, for the jobs created in the local community by PNPP. This will apply to the displaced workers and their family members, therefore, reducing the pool of candidates for employment service organizations to utilize. This would likely be most relevant in VBC and the surrounding area, where PNPP is the largest employer.

3.3.2 FOOD AND BEVERAGE

Background

VBC and the Tri-County area experience high levels of tourism during the summer months. The area has unique natural features with freshwater dunes and natural beaches. It is considered a destination spot for many people from larger cities like Chicago, Illinois, and the surrounding areas. As a result, the food and beverage industry is strongly supported by tourism during the summer months and accounted for nearly 9% of total payrolled employment in both VBC and the Tri-County area as a whole in 2022.[53] Table 15 reflects the 2019-2020 average visitor spending of over $132 million.

As with most communities in Michigan and the United States, COVID-19 had a significant negative impact on the hospitality industry in southwest Michigan. However, this area of Michigan showed resilience to the economic downturn caused by the pandemic. There are no large concert venues, conference centers, or sports arenas frequented in the Tri-County area. Since the region's economy is predominately supported by leisure tourism and travel passing through Van Buren, Berrien, and Cass Counties, these areas were less vulnerable to losing hospitality revenue during and after the pandemic. This is consistent with many shoreline-located counties in Michigan that, on average, experienced an 8% decrease in lodging revenue.[54] This is marginally smaller than the overall lodging revenue lost across the rest of non-shore located counties and the U.S.

Despite the challenges from COVID-19, 2022 remained a strong year for tourism to the Tri-County area, especially the shoreline towns of St. Joseph, Benton Harbor, and South Haven. This strong tourism season helped to see no immediate significant impact on the hospitality sector following the May 2022 closure of PNPP.

Indirect Impacts

According to the IMPLAN results, the loss of employees will impact the food and beverage industry from the loss of 12 jobs in VBC and 57 jobs in the Tri-County area. This loss is supported by the food and beverage industry purchases reflecting a potential loss of $1,611,615 in region purchases from PNPP in Table 16. The largest impact will be felt in "Full-Service Restaurants" with in-region purchases totaling more than $1.4 million.

Since PNPP was a large employer, they purchased from food and beverage vendors in the region. So, the impact will likely be felt by food service contractors that provide on-site dining and catering purchases from local restaurants. In addition, off-site company miscellaneous sponsored events at local restaurants, bars, and other dining establishments may also be impacted. The absence of contract employees visiting the region every 18-24 months and any other visitors provided a per diem to purchase food will also impact the food and beverage industry.

Since the PNPP site will not be immediately fully closed and will continue in scaled-back operation, there will still be some purchases of food and beverages in the region. However, these purchases will be of a smaller magnitude and diminish over time as the plant continues the decommissioning process.

Induced Impacts

According to the IMPLAN results, the closure of PNPP will have an induced impact on food and beverage industry of 19 jobs in VBC and 30 jobs in the Tri-County area.

There will be induced impacts in the region due to the potential loss of community members and their families that engage in food and beverage

industry activity. Since the decommissioning of PNPP has and will lead to people and their families leaving the community, there will likely be less money spent on food and beverage providers.[56] These impacts will be gradual and diminishing over time as the previously employed people transition out of the region. Induced impacts will be mostly offset by the tourism industry that supported the region during the COVID-19 food and beverage demand shock.

Source: Local Restaurant Near PNPP, Photo by Kelly O'Laughlin

Table 15. Hospitality in Southwest Michigan.

Southwest Michigan Region 2019/2020 Averaged Visitor Spending (millions)							
	Lodging*	Food & Beverage	Retail	Recreation**	Transport***	Total	State and Local Tax Revenue (millions)
Berrien County	$74.47	$80.96	$28.25	$108.16	$77.03	$368.87	$40.36
Cass County	$15.78	$22.10	$11.20	$18.01	$16.92	$84.01	$9.15
VBC	$26.98	$29.23	$15.95	$18.58	$30.81	$121.54	$13.33
Tri-County Total	$117.23	$132.29	$55.40	$144.74	$124.76	$574.42	$62.84
Region Total	$262.51	$360.03	$190.49	$344.26	$296.22	$1,453.50	$167.75
State Total	$3,829.04	$5,173.40	$3,319.64	$4,436.13	$5,798.16	$22,556.36	$2,552.97

Source: Pure Michigan[55]

*Lodging spending includes 2nd home valuation

**Recreation includes casino wagering

***Transport includes local and air transportation

Table 16. Food and Beverage Industry Purchases for PNPP in 2022 Q2.

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
722310	Food Service Contractors	$20,217	$9,920	$30,137
722410	Drinking Places (Alcoholic Beverages)	$11,058	$11	$11,069
722511	Full-Service Restaurants	$1,411,491	$501,735	$1,913,226
722513	Limited-Service Restaurants	$160,683	$55,802	$216,485
722515	Snack and Nonalcoholic Beverage Bars	$8,166	$17,318	$25,485
Total		$1,611,615	$584,786	$2,196,402

Source: Lightcast Q2 2022 Data Set, Kinexus Group[57]

3.3.3 RETAIL

Background

Retail is defined as the sale of goods to consumers, in contrast to wholesale, which is sold to business or institutional customers. This includes a broad range of products and services from a variety of stores ranging from large supermarkets to small independently owned businesses, and online or physical stores. There are multiple types of retailers in southwest Michigan. In 2022, the retail sector as a whole represented over one-tenth of total payrolled employment in both VBC and the Tri-County area.[58]

Indirect Impacts

According to the IMPLAN results, the loss of employees will impact the retail industry from the loss of five jobs in VBC and six jobs in the Tri-County area. This loss is supported by the retail industry purchases reflecting a potential loss of $3,021,968 in region purchases from PNPP in Table 17.

The main indirect impact of the PNPP closure comes from the decreasing need to maintain an industrial and office complex of its size and employee capacity, resulting in an impact on retailers' jobs. There will be many processes that may no longer be necessary, for example:

- No longer needing to purchase electronics, facility washroom supplies, office supplies, furniture, vending machines, food, and drink-related products, etc
- No longer needing clothing retailers for custom branded company clothing
- No longer requiring landscaping material and products
- No longer needing fleet vehicles and maintenance products

There are many other instances of retail products like those aforementioned that will be either not needed or needed in a smaller quantity than when the power plant was operating at full capacity.

Specialized retailers will also feel an impact since special industrial equipment is necessary for plant operation and maintenance. Routine purchases are no longer needed, so retailers that may have solely relied on business from PNPP may go out of business resulting in a large indirect impact.

Overall, these impacts will be large since many retail products go into maintaining a facility like PNPP. However, with the scaled-back operation that continues during the decommissioning timeline, these impacts will likely be felt gradually.

Induced Impacts

According to the IMPLAN results, the induced impact of the PNPP closure will result in a loss of 23 jobs in VBC and 35 jobs in the Tri-County area.

The induced impact in the region comes from the decrease of retail purchases that the PNPP employees would have made. The PNPP decommissioning will likely lead to people and their families leaving the area; there has been some indication that some people had left at the time of the Assessment.[59] Therefore, there will be less money spent on retail.[60] These impacts will be gradual and diminishing over time as the previously employed people transition out of the region over time.

Table 17. Retail Industry Purchases for PNPP in Q2.

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
441110	New Car Dealers	$8,379	$165,801	$174,181
441120	Used Car Dealers	$12,010	$22,387	$34,397
441310	Automotive Parts and Accessories Stores	$6,514	$28,938	$35,452
441320	Tire Dealers	$5,016	$17,032	$22,048
442110	Furniture Stores	$827	$15,886	$16,713
443142	Electronics Stores	$1,229	$31,637	$32,866
444110	Home Centers	$11,804	$60,159	$71,963
444130	Hardware Stores	$6,432	$10,429	$16,861
444190	Other Building Material Dealers	$5,633	$36,104	$41,737
444220	Nursery, Garden Center, and Farm Supply Stores	$5,396	$9,082	$14,478
445110	Supermarkets and Other Grocery (except Convenience) Stores	$38,868	$358,396	$397,264
445120	Convenience Stores	$8,633	$16,005	$24,638
445299	All Other Specialty Food Stores	$5,076	$8,579	$13,654
445310	Beer, Wine, and Liquor Stores	$9,741	$17,274	$27,016
447110	Gasoline Stations with Convenience Stores	$2,318,533	$1,989,483	$4,308,016
447190	Other Gasoline Stations	$87,995	$518,956	$606,951
448140	Family Clothing Stores	$1,870	$11,295	$13,165
451110	Sporting Goods Stores	$1,572	$11,160	$12,731
452210	Department Stores	$0	$162,863	$162,863
452311	Warehouse Clubs and Supercenters	$268,012	$78,446	$346,458
452319	All Other General Merchandise Stores	$41,191	$44,212	$85,403
453998	All Other Miscellaneous Store Retailers (except Tobacco Stores)	$3,513	$13,927	$17,440
454110	Electronic Shopping and Mail-Order Houses	$11,959	$728,475	$740,434
454210	Vending Machine Operators	$2,486	$27,247	$29,734
454310	Fuel Dealers	$0	$76,211	$76,211
454390	Other Direct Selling Establishments	$159,278	$74,023	$233,301
Total		$3,021,968	$4,534,007	$7,555,975

Source: Lightcast Q2 2022 Data Set, Kinexus Group[61]

3.3.4 HEALTHCARE

Background

Healthcare is a vital aspect of any community, and the decommissioning of PNPP might have unintended consequences for the healthcare system in VBC and the areas around it. As a result, it is crucial to evaluate the healthcare outlook and needs of VBC, as well as any potential economic and social impacts on the area.

Bronson County released a VBC Community Health Needs Assessment report with many partners in the area.[62] This report was released in 2019, but it still provides important information on healthcare in VBC. The key takeaways from the report:

- There are clear disparities between economic and social classes in VBC that contribute to the overall well-being and health of the community.
- There is a stigma surrounding access to mental health services, despite widespread issues with depression, anxiety, toxic stress, and childhood trauma.
- Poverty is a significant issue in VBC, and it affects residents' ability to access quality healthcare, purchase healthy food, access physical activity, and invest in their futures.
- Covert Township is a food desert, as there was no grocery store in Covert as of 2019. In general, healthy food is hard to come by in VBC.
- Access to quality healthcare is a barrier for VBC residents, as there is no birthing hospital and additional elder care services are needed.
- The healthcare system in VBC is not easily accessible, affordable, or navigable by residents, particularly low-income and marginalized residents.

These impacts are especially heightened in marginalized communities. In VBC, Black and Hispanic communities are the most impacted communities. As mentioned previously, areas such as Covert Township, Hartford, and Bangor will likely be heavily impacted due to their demographic and socioeconomic makeup. The closing of PNPP will only further these disparities and exacerbate challenges for residents. The unknown factors of the plant closure will also likely take a toll on people's mental health, according to local healthcare stakeholders.[63]

Many residents go to hospitals and other healthcare services outside VBC because VBC lacks sufficient healthcare resources. This is troubling for lower-income residents who may struggle to take time off from work to go to a doctor or who may not have easy access to viable transportation options. Furthermore, according to the U.S. Census Bureau, 8.7% of the population of VBC is without health insurance.[64] The closure's impact on the area's health insurance access and coverage is unknown.

The healthcare and social assistance sector represents one of the region's four core sectors that drive Tri-County Area employment, accounting for 1,350 payrolled jobs in VBC and 9,528 in the Tri-County Area in 2022, respectively.[65] This sector also possesses several ladder-able occupational pathways that allow individuals to obtain quality, high-paying jobs through on-the-job experience and educational credentialing. As such, healthcare-related programming is popular among regional postsecondary educational institutions and is a tool for slowing local youth outmigration (i.e., "brain drain").

Indirect Impacts

According to IMPLAN, there will be no indirect impact from the closure of PNPP. This means there will be no loss of jobs stemming from business-to-business purchases from PNPP to the healthcare industry.

Induced Impacts

There is very little academic research on the economic impact of closing nuclear sites on the healthcare industry. From the IMPLAN results (Tables 2-5), there is an induced impact on the healthcare industry in the form of output, while there is little to no induced impact in the form of employment and jobs. According to stakeholder interviews in the area, the actual economic impact of the closure on the healthcare industry is fairly small in VBC.[66] However, it may have more of an effect on the areas surrounding VBC, where residents may go to receive treatment.

In 2017, total health care and social assistance receipts/revenue was $197,284,000 in VBC.[67] This includes all establishments providing healthcare and social assistance for individuals. There has not been updated data on this revenue as of January 2023. A large impact is unlikely to impact these establishments, but the full impact is unknown.

There are potential long-term healthcare impacts resulting from the PNPP closing that may not be seen for a while. The above impacts on healthcare could have further implications for the community, including the quality of healthcare, overall resources available, and employment in the future, which are already significant issues for the area.

The total impacted purchases from PNPP in Q2 is $185,056, with the greatest impact on imported purchases from general medical and surgical hospitals. The in-region purchases were very small.

Table 18. Healthcare Industry Purchases in Q2

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
622110	General Medical and Surgical Hospitals	$0	$116,366	$116,366
621111	Offices of Physicians (except Mental Health Specialists)	$1,560	$43,191	$44,751
624120	Services for the Elderly and Persons with Disabilities	$272	$3,513	$3,785
623110	Nursing Care Facilities (Skilled Nursing Facilities)	$1,428	$891	$2,319
621610	Home Health Care Services	$3,173	$14,663	$17,835
Total		$6,433	$178,624	$116,366

Source: Lightcast Q2 2022 Data Set, Kinexus Group[68]

3.3.5 ELECTRIC POWER TRANSMISSION & GENERATION

Background

The electricity market involves a series of processes to deliver electricity to consumers. Electric generation is the initial stage of the energy-making process and involves converting power from a generation source. Nuclear power comes from nuclear fission, where atoms are split apart, releasing energy within a nuclear reactor.[69] The heat generated during nuclear fission in the reactor core is used to boil water, which creates steam that turns the blades of a steam turbine. This motion drives generators to produce electricity.

The next step is electric power transmission, where large amounts of electricity are transported over long distances to reach consumers.[70] Electricity produced at a power generation plant, such as PNPP, is sent to a step-up transmission substation. The substation uses large power transformers to increase the voltage to enable long distance transmission. The electricity is then transferred through a vast network of transmission power lines and transmission towers, known as the transmission grid. As electricity nears populated areas it is delivered to a substation where the voltage is reduced to a suitable level for consumer usage.[71]

The electric power generation, transmission, and distribution industry group, while having a relatively minor regional employment footprint, had the fifth-highest average earnings per job of all industry groups in the Tri-County area at $215,136 annually in 2022.[72]

Indirect Impacts

According to the IMPLAN results, the closure of PNPP will have an indirect impact on electric power transmission and generation, with 20 lost jobs in the Tri-County area.

The impact of the PNPP closure is complex because PNPP had to go through procedures to prove that the closure would not negatively impact transmission system reliability.[73] For a power plant to close, it must submit an Attachment Y Notice to the Independent Service Operator (ISO) that it services at least 90 days before its closure. PNPP submitted this to MISO in March 2018. MISO then did a study to prove that the transmission system can continue to operate reliably if the plant goes offline. MISO found that PNPP closure will not impact the reliability of the transmission system.[74] The closure of PNPP obviates the need for the step-up transformers outside of the plant, along with a small amount of transmission interconnection facilities.

Source: PNPP Sunset, Photo from Entergy

In addition, utility companies like Consumers Energy have to submit an Integrated Resource Plan (IRP) to provide a roadmap for how the utility will meet its future electricity needs to serve customers in a cost-effective and reliable manner.[75] The IRP ensures that Consumer Energy has a plan in place to replace the loss of supply from decommissioning power plants. The IRP must be approved by the Michigan Public Service Commission (MPSC) and proves that the utility is able to meet customer demand.[76] MPSC has approved Consumer Energy's IRP from 2018-2022, indicating that there is no risk to reliability of energy to customers.

Table 19 indicates that PNPP purchases electric power distribution, electric bulk power transmission and control, and a variety of other purchases for power generation. The loss of PNPP as a purchaser will have an impact on the power energy market as a result of the closure.

Induced Impacts

According to the IMPLAN results, the closure of PNPP will have an induced impact on the electric power transmission and generation industry of less than one job lost in the Tri-County area. In the long run, there may be an impact to the transmission industry as a result of the closure causing people to move away from the region.

According to Lightcast, PNPP purchases power generation from multiple sources. Although these amounts may not reflect a direct labor impact in the area, they do reflect the loss of purchasing from other power generation sources by PNPP. Table 19 reflects these purchases, but does not necessarily indicate a large impact directly to southwest Michigan.

Table 19. *Electric Power Transmission & Generation Purchases in Q2*

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
221122	Electric Power Distribution	$0	$24,181,089	$24,181,089
221112	Fossil Fuel Electric Power Generation	$0	$9,779,779	$9,779,779
221113	Nuclear Electric Power Generation	$5,523,110	$67,130	$5,590,240
221121	Electric Bulk Power Transmission and Control	$0	$3,409,385	$3,409,385
221111	Hydroelectric Power Generation	$0	$878,431	$878,431
221115	Wind Electric Power Generation	$0	$739,044	$739,044
221114	Solar Electric Power Generation	$0	$450,102	$450,102
221118	Other Electric Power Generation	$0	$345,748	$345,748
221117	Biomass Electric Power Generation	$0	$182,697	$182,697
221116	Geothermal Electric Power Generation	$0	$114,852	$114,852
Total		$5,523,110	$40,148,257	$45,671,367

Source: Lightcast Q2 2022 Data Set, Kinexus Group[77]

3.3.6 OTHER REAL ESTATE

Background

The activities related to the other real estate industry accounted for 66 total payrolled jobs in the Tri-County area in 2022.[78] Other real estate includes businesses primarily engaged in performing real estate services, such as real estate escrow agencies, real estate listing services, and real estate fiduciaries' offices.

Indirect Impacts

According to the IMPLAN results, the closure of PNPP will have an indirect impact on the other real estate industry from the loss of seven jobs in VBC and 17 jobs in the Tri-County area.

PNPP leases land from local property managers for various reasons, one predominantly being offsite locations needed in an emergency. For example, some real estate developers in the Tri-County area lease land to PNPP and, therefore, will be substantially affected by the closure of PNPP through a loss of business.[79] However, those leases and tenants do not directly impact community revenue. Therefore, real estate development is likely to be more indirectly impacted in the short-run than the long-run, and only for some developers/agents.

Induced Impacts

According to the IMPLAN results, the closure of PNPP will have an induced impact on the other real estate industry from the loss of three jobs in VBC and seven jobs in the Tri-County area.

In the long run, induced impacts on other real estate is more likely to happen from the displacement of those formerly employed by PNPP. If there continues to be population and skill-set loss, then real estate will have a more difficult time filling in empty retail and businesses.

Table 20. Other Real Estate Purchases in Q2

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
531110	Lessors of Residential Buildings and Dwellings	$802,721	$1,591,953	$2,394,674
531120	Lessors of Nonresidential Buildings (except Miniwarehouses)	$1,049,162	$556,022	$1,605,184
531130	Lessors of Mini Warehouses and Self-Storage Units	$212,082	$368,106	$580,188
531190	Lessors of Other Real Estate Property	$401,775	$9,911	$411,685
531210	Offices of Real Estate Agents and Brokers	$1,484,679	$441,529	$1,926,208
531311	Residential Property Managers	$171,225	$753,056	$924,281
531312	Nonresidential Property Managers	$247,137	$278,147	$525,284
531320	Offices of Real Estate Appraisers	$110,666	$2,977	$113,643
531390	Other Activities Related to Real Estate	$887,750	$514,361	$1,402,110
Total		$5,367,197	$4,516,062	$9,883,257

Source: Lightcast Q2 2022 Data Set, Kinexus Group[80]

3.3.7 OTHER LOCAL GOVERNMENT ENTERPRISES

Background

Local government enterprises include public sector organizations, businesses, or services that the local government owns in order to provide services or create revenue for localized communities. These entities generate revenue from services such as public utilities and facilities to maintain public spaces, including waste management, remediation services, water treatment, sewage management, and others. Some government enterprises may enter private sector-like activities, such as city-owned hotels, ports, parking lots, and airports. Excluding education and hospitals, the public sector accounted for 1,086 payrolled jobs in VBC and 6,047 in the Tri-County area in 2022.[81]

In southwest Michigan, water facilities are municipal enterprises. The PNPP closure may impact water facilities since the operation of a power plant requires a large amount of water for heating and cooling purposes to generate electricity. PNPP facilities are located on the shores of Lake Michigan and therefore have access to large bodies of water but likely have had to collaborate with the local public water works to establish pumping infrastructure.

Indirect Impacts

According to the IMPLAN results, the loss of employees will have an indirect impact on the other local government enterprise industry from the loss of two jobs in VBC and 15 jobs in the Tri-County area. This loss is supported by the other local government enterprise industry purchases which reflects a potential loss of $128,006 in region purchases from PNPP in Table 21.

Other impacts may include a decreased demand for other public works such as waste management, remediation services, sewage, and water treatment coming from the PNPP. Although there will be impacts from the loss of the operation, the PNPP will not be fully closed until the decommissioning process is complete. This is not anticipated for another 10-20 years (around the 2030s-2040s).

In the meantime, scaled-back operations will continue and other local government enterprise services will still be required. Table 21 shows some industries which may be considered other local government enterprises. There will be an effect from the PNPP closing, and a summary of the yearly purchasing total is reflected in Table 21. A large industry impact will be from Natural

Source: Covert Township Water Tower, Photo by Kelly O'Laughlin

Gas Distribution. About $1,641,163 of purchases from natural gas distribution were made by PNPP because their facilities were likely to have been heated with natural gas. Other purchases were made for waste, sewage, and water treatment. These are normal costs associated with operating a facility like the PNPP. The full magnitude of the effects will be largely unknown since the continued operation means that other local government enterprise services will continue to be needed.

Induced Impacts

The induced impact will be felt from the loss of employees in the community no longer requiring local government enterprise services to the same degree. As community members may relocate due to the loss of their job at PNPP, this will result in a lower need for public works like utilities, facilities management, and waste management.

This impact will be minimal since many services of other local government enterprises are determined at the aggregate level and do not necessarily feel a direct impact from the loss of one resident. Those who remained in the area will not likely create a large impact including those who retired, found other work, or found other opportunities like education. The largest impact would be felt by the relocation of employees. However, if people move away it will be at a gradual pace. Therefore, the effects will be felt over a longer period of time. The exact impact is unknown due to the multiple and collective levels of decisions made through other local government enterprises.

Table 21. Other Local Government Enterprises Industry Purchases for PNPP in Q2

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
221210	Natural Gas Distribution	$0	$1,641,163	$1,641,163
221320	Sewage Treatment Facilities	$0	$715,298	$715,298
562111	Solid Waste Collection	$38,864	$460,760	$499,624
562910	Remediation Services	$13,970	$305,638	$319,608
237110	Water and Sewer Line and Related Structures Construction	$63,676	$194,693	$258,369
562212	Solid Waste Landfill	$0	$149,917	$149,917
562211	Hazardous Waste Treatment and Disposal	$0	$146,902	$146,902
562998	All Other Miscellaneous Waste Management Services	$0	$64,304	$64,304
562112	Hazardous Waste Collection	$11,496	$29,489	$40,986
562119	Other Waste Collection	$0	$36,909	$36,909
562213	Solid Waste Combustors and Incinerators	$0	$24,762	$24,762
Total		$128,006	$3,769,835	$3,897,842

Source: Lightcast Q2 2022 Data Set, Kinexus Group[82]

3.3.8 FINANCIAL SERVICES

Background

According to the NAICS, financial services include the following: nondepository credit intermediation, activities related to credit intermediation, securities and commodity contract intermediation, brokerages, and exchanges, and other financial investment activities.[83] These are all industries related to the routine financial activities associated with operating any business including power plants. Like the electric power transmission and generation industry group, the financial services industry has a minor employment footprint regionally, but it consists of high-paying occupations. For example, in 2022, the average annual earnings per job for the financial services industry in VBC were $134,202 and $135,650 at the Tri-County level.[84]

Indirect Impacts

According to the IMPLAN results, the loss of employees will have an impact on the financial services industry from the loss of four jobs in VBC and nine jobs in the Tri-County area. This loss is supported by the financial services industry purchases reflecting a potential loss of $568,965 in region purchases from PNPP in Table 22.

According to the industry purchases, most of the effects will be due to the loss of the PNPP employer purchasing other businesses' services within the financial services industry.[85] Financial services are essential for any employer, and since PNPP was a relatively large employer in the area there will be large impacts. Standard employment of financial services includes payroll processing, payment (credit card) processing, banking, accounting, taxes, etc.

The highest impacted sub-industries are portfolio management and investment advice. These financial sub-industries experienced more than $150,000 in region purchases from the PNPP when in full operation.

Induced Impacts

The induced impact will be felt from community members that no longer require local financial services in the same capacity as they were able to before the power plant closed. These services include anything necessary for community members to manage personal finances and other financial activities. The two main causes will be the loss of residents and employees that relocate to other areas and the lower salaries or loss of income to be put towards financial activities. These effects will be gradual and felt over time.

Source: Covert Township Road, Photo by Kelly O'Laughlin

Table 22. Financial Services Industry Purchases for PNPP in Q2

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
522210	Credit Card Issuing	$0	$99,179	$99,179
522220	Sales Financing	$3,198	$121,788	$124,986
522291	Consumer Lending	$1,273	$103,915	$105,188
522292	Real Estate Credit	$16,805	$437,550	$454,355
522293	International Trade Financing	$0	$15,766	$15,766
522294	Secondary Market Financing	$0	$33,514	$33,514
522298	All Other Nondepository Credit Intermediation	$4,190	$76,512	$80,701
522310	Mortgage and Nonmortgage Loan Brokers	$25,950	$166,016	$191,966
522320	Financial Transactions Processing, Reserve, and Clearinghouse Activities	$0	$213,665	$213,665
522390	Other Activities Related to Credit Intermediation	$0	$99,291	$99,291
523110	Investment Banking and Securities Dealing	$0	$294,264	$294,264
523120	Securities Brokerage	$48,962	$407,358	$456,320
523130	Commodity Contracts Dealing	$0	$29,242	$29,242
523140	Commodity Contracts Brokerage	$0	$15,933	$15,933
523210	Securities and Commodity Exchanges	$0	$12,487	$12,487
523910	Miscellaneous Intermediation	$33,659	$85,236	$118,895
523920	Portfolio Management	$157,700	$524,285	$681,986
523930	Investment Advice	$255,509	$34	$255,543
523991	Trust, Fiduciary, and Custody Activities	$3,180	$14,670	$17,850
523999	Miscellaneous Financial Investment Activities	$18,539	$7,440	$25,979
Total		$568,965	$2,758,145	$3,327,110

Source: Lightcast Q2 2022 Data Set, Kinexus Group[86]

3.3.9 TRUCK TRANSPORTATION & SUPPORT ACTIVITIES

Background

The PNPP operations relied heavily on multiple transportation systems to receive purchases. The industrial size, complexity of operations, age of the site, location, and security all influenced the many transportation services that PNPP utilized.

PNPP was a large and aged industrial site that relied on many processes to keep the plant and workers functioning. Operations required materials and substances for the plant to produce electricity and function safely. The vast majority of these materials were transported to the plant by truck transportation because PNPP could only be reached by motorized vehicles. However, some purchased materials were transported by air, rail, water freight, and pipeline before reaching the final PNPP destination by truck transportation.[87] All of these modes of transportation were supported by additional transportation services such as transportation arrangements, vehicle towing, cargo handling, etc.

PNPP had regularly scheduled truck shipments that brought the materials needed to keep the site operating smoothly. Since PNPP had extra security, the trucks had to be thoroughly inspected and cleared to enter the site. This contributed to additional time and costs for the transportation service.

Trucking jobs are heavily determined by the margins between the delivery charge and delivery costs (i.e., hours worked, extra security, and material maintenance requirements). Therefore, truck transportation services for PNPP would cost more due to the additional precautions and sensitive or hazardous materials being transported to and from the plant.

Items typically transported to and from nuclear power plants:[88]

- Building and construction materials
- New fuel and petroleum
- Safety equipment
- Trash removal
- Low-level radioactive/hazardous waste material removal

Indirect Impacts

The IMPLAN model displayed a higher impact on employment within truck transportation and transportation support services, with the loss of eight jobs in VBC and 15 jobs in the Tri-County area. The truck transportation and support activities industry purchases supported this because it showed higher purchasing amounts for truck transportation and for additional transportation support activities compared to all other relevant transportation services.[89]

The total truck transportation purchases showed to be $8,940,140, with the majority of the purchases for truck transportation services being within businesses in VBC ($6,089,400).[90] However, the truck transportation and support activities industry purchases showed there was about twice as much spent on transportation support activities, with a total of $16,816,719. The majority of these transportation support activities were spent outside of VBC ($15,133,359).[91] This means that the closure may affect truck transportation businesses in VBC. Since the majority of spending on transportation support activities was outside of VBC, it is difficult to identify the extent of impact for transportation support activities.

Induced Impacts

According to IMPLAN, the loss of employees in the region will have a minimal induced impact of the loss of one job in VBC and two jobs in the Tri-County area in the truck transportation and support activities industry.

3.3.10 PHILANTHROPIC

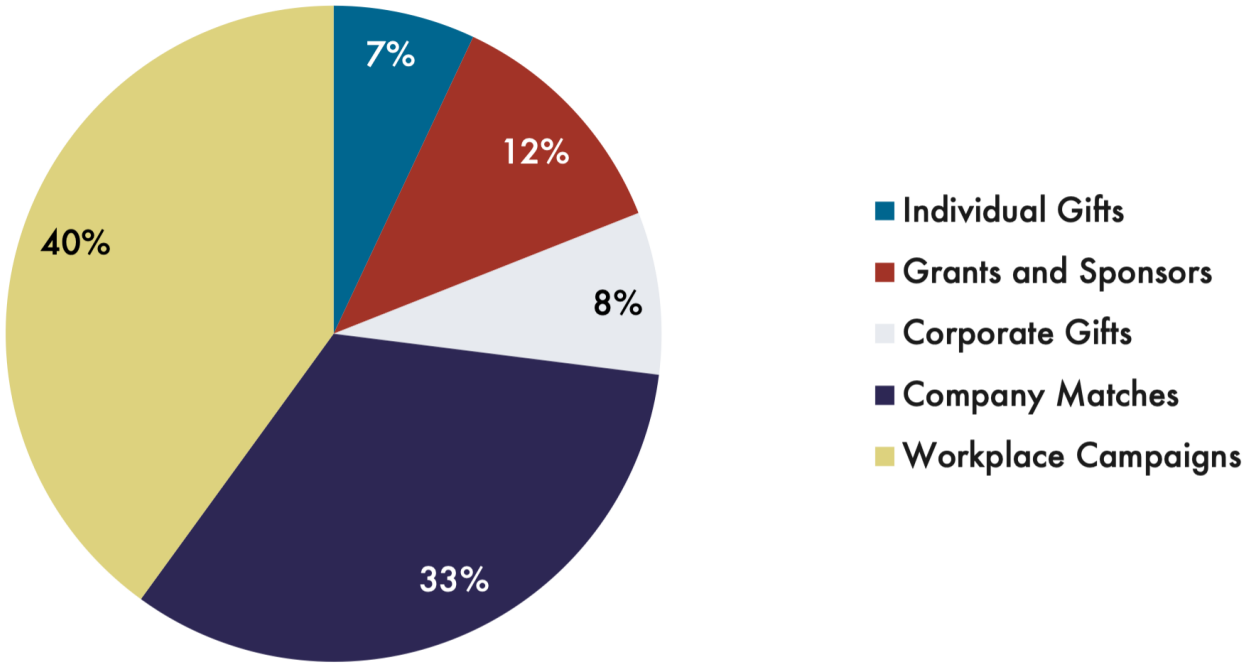
Background

The population of VBC in 2021 was 75,658. The poverty rate of VBC was 14.1% in 2021, which is 1.5% higher than the state poverty rate of 12.6%.[92] The population of Berrien County in 2021 was 987,581. The poverty rate of Berrien County was 15.1%, which is 2.5% higher than the state average.[93] The population of Cass County in 2021 was 75,798. The poverty rate of Cass County was 11.1%, which is 1.5% lower than the state average.[94]

United Way of Southwest Michigan (UWSWM) is the largest philanthropic provider in VBC. The organization has served VBC, Berrien, and Cass counties since 2020. Before that, VBC was separately served through the United Way of VBC. In 2021 UWSWM's Annual Report reported that 37% of households in VBC, Berrien, and Cass counties struggle to meet their basic needs and cite the increasing costs of living, low wages and less job security, and residual strain from the Great Recession as issues impacting southwest Michigan, particularly for individuals considered "asset limited, income constrained, and employed."

In 2021, UWSWM raised $5,092,203 total, including $562,578 of in-kind donations and an additional $479,413 worth of volunteer service hours. UWSWM's revenue sources are described in Figure 8. One of UWSWM's primary operations is managing the donations of corporations which had previously included a partnership with Entergy.[95] A full list of the Corporate Campaign Supporters can be found in the UWSWM 2021 Annual Report.

Figure 8. United Way of Southwest Michigan Revenue Sources.



Source: United Way of Southwest Michigan Revenue Sources, Format by Sarah Fleckenstein from 2021 UWSWM Annual Report[96]

UWSWM worked with Entergy to manage their corporate giving since 2016 after United Way of Van Buren County (UWVBC) consolidated with UWSWM. Before that, Entergy worked with UWVBC to manage their corporate donations. UWSWM was a larger entity than UWVBC, serving the entire Tri-County area and receiving more contributions. 2022 will be the first year that UWSWM will not receive funds from Entergy. However, the larger revenues have allowed the organization to prepare for the transition and seek alternative funding from other businesses.

While changes in corporate giving in the area are an area of concern, other issues the organization and the sector faces are changes in the amount of donations and the demand of services during the COVID-19 pandemic and unstable economic conditions, generational shifts, and differences in donation tendencies. There were temporary changes that affected donations and service demand. For example, the COVID-19 pandemic was a unique circumstance in which monetary donations increased, but demand for services supported by those donations increased simultaneously. In addition, decreasing stability in economic conditions beginning around 2020 has further increased the demand for services supported through philanthropic donations.[97]

Long-term changes were also noted as issues the organization and the philanthropic sector have had to adapt to. Specifically, UWSWM identified a difference in generational giving patterns. In older generations, individuals are more likely to give consistent (e.g., monthly, yearly) monetary donations. Whereas in younger generations, individuals are not consistently donating as much. This trend has made individual non-governmental organizations (NGO) more reliant on organizations like United Way to funnel donations to them through corporate giving. However, generational changes are seen at the corporate level as well. UWSWM shared that they have noticed that as the younger generations inherit corporations from their older family members, the level of giving does not always remain the same, noting that their investment in the community is not always the same.[98]

UWSWM typically adapts to a changing supply of monetary donations and demand for philanthropic services. However, the current short-term trends from COVID-19 and economic instability, and the long-term trends linked to generational changes in giving, increase the significance of each corporate campaign, such as that of Entergy.

Entergy

UWSWM worked with the Entergy Foundation to help Entergy with their community philanthropic activities.

Table 24 outlines the charitable contributions from Entergy Foundation to the UWSWM that were funneled to the communities of southwest Michigan.

The money given by the Entergy Foundation to United Way is not designated for specific organizations but goes to UWSWM to support their aforementioned community goals.

Entergy also had a long-standing partnership with the Van Buren Intermediate School District (VBISD). Over 2021, Entergy supported five programs with $148,000 for students, such as the 2021 and 2022 Back to School Backpack Giveaway, SimCity Development, donations of medical equipment like CPR manikins and AED machines, Habitat Trail Revitalization, and the Pavilion Shelter Rebuild.[99] According to an

interview with VBISD, this was much more than Entergy had given in the past, but Entergy's donations would increase and decrease depending on VBISD's needs. They stated that over the past 10 years Entergy donated about $400,000 to VBISD.[100]

Holtec

Specific information regarding Holtec's giving campaigns in southwest Michigan remains uncertain.[101] However, Holtec has had campaigns in other communities experiencing similar transitions. In Camden, NJ Holtec employees organized a food drive. In New

Table 23. UWSWM Gifts from 2017-2021

Campaign Year	Total for Year	Corporate Gifts	Employee Gifts	Special Events	Non-Campaign Gifts	Other Contributions
2021	$43,353.22	$21,626.61	$21,726.61	-	-	-
2020	$60,134.36	$23,690.61	$23,690.61	-	$12,753.14	COVID Fund
2019	$59,754.84	$34,272.07	$25,432.77	-	$50.00	Annual Celebration Reservations
2018	$38,316.93	$13,730.16	$24,586.77	-	-	-
2017	$42,805.69	$14,036.92	$28,768.77	-	-	-
5-Year Totals	$244,365.04	$107,356.37	$124,205.53	-	$12,803.14	

Source: United Way of Southwest Michigan

Table 24. Entergy Partnerships with VBISD

Program	Description
Back to School Backpack Giveaway	All VBC Students can receive free school supplies.
SimCity Development	Hands-on SimCity training for students in law enforcement, emergency medical technician, and Fire Science Academy programs.
New CPR Mannequins and AED Trainers	Provides CPR Mannequins and AED Trainers to school districts for training purposes
Habitat Trail Revitalization	Provided funds for a habitat trail across a 35-acre stretch of natural wildlife habitat including a half-mile boardwalk with access for individuals with mobility difficulties.
Pavilion Shelter Rebuild	Provided funds for the Bert Goen Learning Center which provides educational services to VBC students with moderate to severe disabilities.

Source: Van Buren County Intermediary School District

Mexico Holtec donated over 1,500 personal protective equipment masks to different organizations and facilities during the beginning of the COVID-19 pandemic. In Plymouth, MA Holtec also donated over 2,000 masks and 14,000 nitrile examination gloves to organizations and facilities in the community during the beginning of the COVID-19 pandemic.[102]

Indirect Impacts

According to the IMPLAN results, the closure of PNPP will have a very minimal indirect impact on the philanthropic industry with less than one job lost total.

The philanthropic industry is crucial for the Tri-County area. While Entergy's corporate campaign was only a portion of the total monetary donations in the area, there was increased dependency on corporate donations during and after the years of the COVID-19 pandemic. Additionally, Entergy's partnership with the VBISD supported programs that provided essential services to students to assist them with in-school and out-of-school learning. There is no clear path to reallocate funds from a different company to fund these programs because this was a direct campaign.

Induced Impacts

According to IMPLAN results, the loss of employees in the region will have an induced impact of the loss of seven jobs in VBC and 10 jobs in the Tri-County area.

Additionally, the cumulative impact of Entergy's corporate campaign and the lost donations from the individual employees who are leaving the area, means that there will likely be a noticeable impact on the philanthropy industry in the Tri-County area.

3.3.11 SCIENTIFIC RESEARCH & DEVELOPMENT SERVICES

Background

Since nuclear energy is a low-carbon, reliable, 24-7 capacity source, there have been some considerations for the advancement in nuclear technology to help reach the United States' energy goals towards zero-carbon emissions.[103] As a result, research efforts may be needed to advance and develop nuclear technology. Research into nuclear energy advancement is predominantly done in national laboratories and academic universities, with some private sector activities occurring. Active power plants are seldom used in traditional research.

The scientific research and development services industry group has an extremely large employment footprint in VBC, with there being over 15 times more payrolled jobs in this industry group than would be expected, given national averages. In total, the industry group accounted for 1,812 jobs in VBC, or 8.3% of countywide employment in 2022. This industry group also provides high-wage occupational opportunities, with average annual earnings per job of $82,402 in 2022.[104] Industry groups such as this are key to high-skilled talent attraction, which in turn benefits future economic development in VBC.

The two predominant industries impacted by the PNPP closure consist of "establishments primarily engaged in conducting biotechnology (except nanobiotechnology) research and experimental development."[105] This sector includes research and experimental development involving the study of the use of microorganisms and cellular and biomolecular processes to develop or later living or non-living materials.

Indirect Impacts

According to the IMPLAN results, the closure of PNPP will have an impact on the scientific research and development services industry resulting from the loss of eight jobs in VBC and seven jobs in the Tri-County area. This loss is supported by the scientific research and development services industry purchases reflecting a potential loss of $23,427 in region purchases from PNPP in Table 25 and a total potential loss of $56,694.

Induced Impacts

According to IMPLAN results, the closure of PNPP will create an induced impact where two jobs will be lost in VBC and two lost jobs in the Tri-County area.

3.3.12 CONSULTING, MANAGEMENT, & OFFICE SUPPORT SERVICES

Background

Consulting, management, and office support services are the broad range of activities that go into the administrative support and management of a business. Consulting services are professional services that provide more specialized or expert support for certain activities. Nuclear power plant consulting activities may include performing design, analysis, testing, and troubleshooting of components.[106] Jobs in consulting, management, and office support services are also high-wage employment opportunities, with average annual earnings per job in 2022 of $104,568 in VBC and $111,544 in the Tri-County area, respectively.[107]

Indirect Impacts

According to the IMPLAN results, the closure of PNPP will have an impact on the consulting, management, and office support services industry from the loss of six jobs in VBC and seven jobs in the Tri-County area. This loss is supported by the consulting, management, and office support services industry purchases from PNPP, reflecting a potential loss of $3,149,406 in region purchases from PNPP in Table 26.

The largest impacted industry within consulting, management, and office support services will be: "All Other Professional, Scientific, and Technical Services," which is made of "provision of professional, scientific, or technical services."[108]

Induced Impacts

According to the IMPLAN results, the loss of employees will have a minimal induced impact on the consulting, management, and office support services industry from the loss of two jobs in VBC and one job in the Tri-County area.

Table 25. Scientific Research and Development Services Industry Purchases for PNPP in Q2

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
541714	Research and Development in Biotechnology (except Nanobiotechnology)	$23,427	$33,266	$56,694
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)	$74,525	$2	$74,527
Total		$23,427	$33,266	$56,694

Source: Lightcast Q2 2022 Data Set, Kinexus Group

Table 26. Consulting, Management, and Office Support Services Industry Purchases for PNPP in Q2 2022

NAICS	Purchases from	In-region Purchases	Imported Purchases	Total Purchases
541910	Marketing Research and Public Opinion Polling	$406,980	$1,178,606	$1,585,586
541930	Translation and Interpretation Services	$43,396	$477,873	$521,269
541990	All Other Professional, Scientific, and Technical Services	$2,474,190	$5,556,062	$8,030,252
551112	Offices of Other Holding Companies	$1,316	$8,437	$9,753
551114	Corporate, Subsidiary, and Regional Managing Offices	$91,527	$103,848	$195,374
561110	Office Administrative Services	$131,997	$3	$131,999
Total		$3,149,406	$7,324,829	$10,474,233

Source: Lightcast Q2 2022 Data Set, Kinexus Group[109]

Source: PNPP Parking Lot, Photo from Entergy, Accessed: June 28, 2023, https://www.powermag.com/palisades-nuclear-power-plant-closes-after-50-years-of-operation-employees-leave-with-pride/

4 OTHER IMPORTANT CONSIDERATIONS

4.1 CONTRACT WORKERS DURING ROUTINE POWER PLANT CLOSURES IMPACTS

Nuclear power plants require scheduled outages every 18 to 24 months during the refueling cycle.[110] Scheduled during spring or fall months to match lower electricity demand, these routine outages allow reactors to reduce electricity generation activities to replace approximately 1/3rd of spent fuel rods with new fuel and do other maintenance and operation activities.[111] These outages can take as little as 10 days to complete the refueling system but the United States' average number of refueling outage days is 32 outage days.[112],[113] In general, PNPP would be closed for about 30-60 days.

During these closures, about 1,200-1,500 contractors would come to southwest Michigan. The presence of contract workers during off-peak tourism season would provide a boost to the local economy during a time of lower economic activity.[114] Many of the top industries impacted defined by IMPLAN would receive stimulus as a result including:

- Food and Beverage
- Retail
- Lodging
- Recreational
- Transportation
- Shipping of materials for repairs and refueling

Since contractors were in the region for up to 60 days, the short-term rentals, hotel, and campgrounds in southwest Michigan would experience a boost. Contractors were also given daily per diem to be spent on food and beverage, which provided a stimulus to local restaurants and dining establishments. Recreational activities would see an increase as contractors would remain in the area for nighttime and weekend activities. The increased number of workers on site also meant there were more shipments to PNPP, which would increase transportation needs in the area. The outages required additional shipments of materials for repairs and refueling. All of the regular products required for operations and employees increased as well. As an example, the contract workers brought in additional needs for safety equipment, paper products, food, and trash waste that would be transported to or hauled from PNPP.

The decommissioning of PNPP means that there will no longer be the need for routine maintenance on site, therefore contract workers will no longer be present during off-peak tourism season. Some of the businesses in the area experience extremely slow "off-season" business and the loss will negatively impact gross profits as a result. This area is still heavily supported by summertime tourism, but the contract workers played an important stimulating role in the off-season.

Source: Leisure Tourism, Photo by Kelly O'Laughlin

4.2 TRANSPORTATION: COMMUNITY & FREIGHT MOVEMENT IMPACTS

As salaries decrease, the overall transportation system may be affected by slightly reducing household trips taken and reducing the amount of household spending. The Tri-County area is mainly made up of rural, low-density, and automobile-oriented land use. This results in a very car-dependent region, which means that transportation will very likely continue as usual. All of the roughly 600 PNPP employees commute by car and/or carpool; therefore, public transportation will not be affected.[115] The first phase of decommissioning includes roughly 250 employees continuing to work, which will decrease commuters using roads and highways to get to PNPP.

Overall employee salaries will decrease, and the households that are impacted by the induced impacts on businesses will decrease income levels; therefore, it will decrease overall purchasing and potentially reduce the region's purchasing demand. This impact from the reduction in purchasing will not be noticed by large regional retailers or grocers. It will not impact the national scale supply chain, nor the freight shipments involved.

Source: Palisades Power Plant Rd, Photo by Kelly O'Laughlin

The closure will minimally impact driving trends, but it will decrease the number of commuters on the road to PNPP.

4.3 HOUSING & COMMUNITY IMPACTS

Background

There has been public notice of PNPP's decommissioning since 2016.[116] This provided years for the workers to contemplate job changes. Though decommissioning will decrease the number of jobs over time, the economic impact on households and the housing market will be spread out over a longer period of time compared to the economic shocks of stopping PNPP operations. Many of the PNPP employees commute from neighboring counties, which will also reduce this household impact by diluting the impact between different areas. This leaves many opportunities for policy and economic growth to alter the trajectory of negative impacts into more positive outcomes.

Housing Supply Analysis

The majority of the PNPP employees reside in VBC (36%, 212 employees) and Berrien County (35%, 210 employees). A number of employees also live in the surrounding counties of Allegan, Kalamazoo, Ottawa, Kent, and Cass Counties, with some residing even further away or out of state.[117] The Housing Supply Analysis describes the existing housing market in the Tri-County area. It includes an inventory of the current

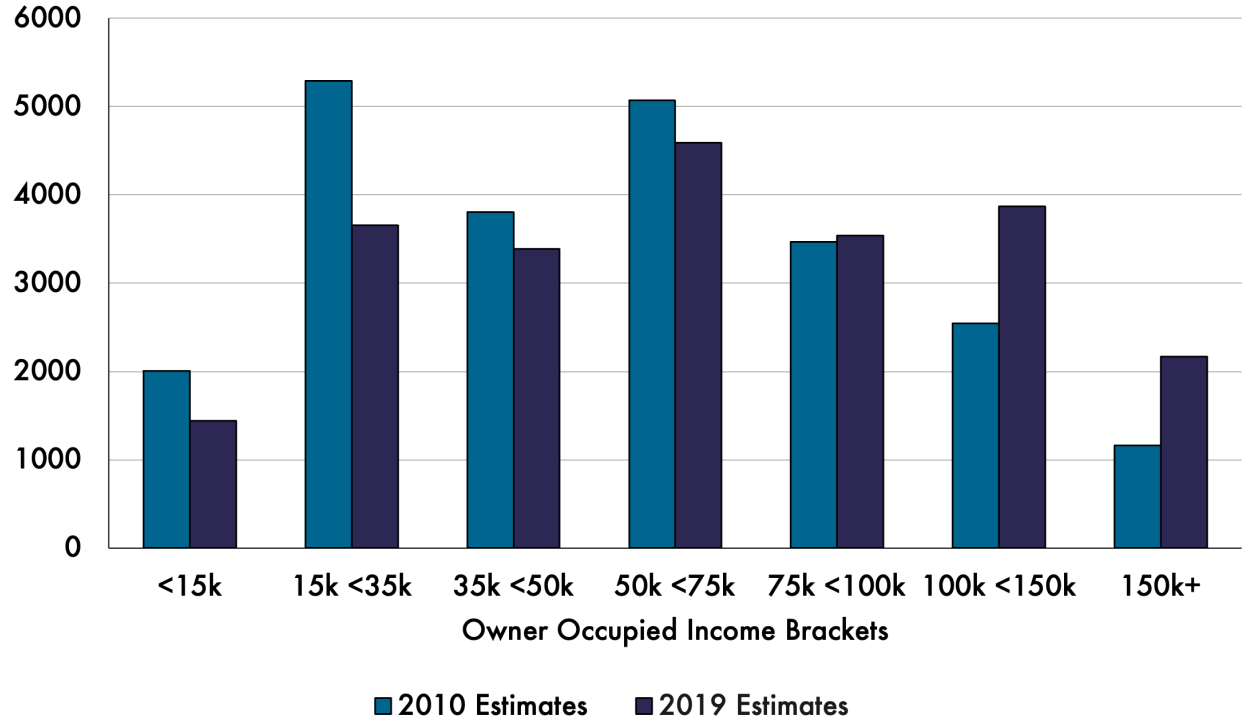
housing stock and reviewing both owner-occupied and rental properties in the Tri-County area to better understand the size and quality of the stock.

Housing Supply Analysis: Owner Occupied

In VBC, the American Community Survey (ACS) 5-Year Estimates show that the number of homeowners decreased by 701 units (from 23,339 in 2010 to 22,638 in 2019). Additionally, the household incomes of homeowners are increasingly becoming a demographic of solely high earners (see Figure 9). However, all income intervals below $75,000 annual household income showed a loss in the number of households. This suggests that the rising cost of homeownership may be difficult to surmount for lower-income households. Additionally, there may be a higher-than-normal rate of people leaving the homeownership market and switching to renting.[118]

Similar trends were seen in Berrien and Cass Counties. In Berrien, the number of owner-occupied housing units decreased by 550 units (from 45,564 in 2010 to 45,014 in 2019). The only households to show an increase in homeownership rate were high earners (increase in households that are owners for the following high-income brackets: of $100,000 to $149,999 (+2,046) and $150,000 or more (+2,588) in Berrien County). In Cass, the number of owner-occupied housing units has stabilized (with 16,718 in 2010 and 16,819 in 2019). Similar trends were observed in Cass County.

Figure 9. Homeownership by Household Income in Van Buren County.



Source: Homeownership by Household Income in VBC, Format by Sarah Fleckenstein from 2010 & 2019 ACS 5-Year Data, United States Census Bureau[119]

The overall cost of homeownership ranges from $125,000 to $150,000 in the Tri-county area (Table 27). However, there is evidence of a significant housing shortage across southwest Michigan. While there are many owner-occupied residences, many of the quality affordable homes are taken, with only newly constructed, large, expensive homes and low-quality homes remaining.[120] This impact is likely to be especially prevalent for medium-wage workers in the tourist destination markets along Lake Michigan.

Table 27. *Median Home Values 2010 to 2019*

County	% Change	Median Home Value 2010	Median Home Value 2019
Berrien	+11.1%	$135,600	$150,700
Cass	+6.8%	$133,700	$142,800
VBC	+11.5%	$125,000	$139,400

Source: 2010 & 2019 ACS 5-Year Data, Format by Sarah Fleckenstein from United States Census Bureau[121]

Housing Supply Analysis: Rental Properties

The number of rental units is rising across the Tri-County area. According to the ACS 5-Year Data Estimates, between 2010 and 2019, the number of housing units operating as rentals has increased by 1,603 units (17,048 to 18,651) in Berrien County, increased by 717 units (3,483 to 4,200) in Cass County, and increased by 1,016 units (5,757 to 6,773) in VBC. In VBC, the median gross rent grew from $572 to $705 between 2010 and 2019, and 48.6% of rental households were paying over 30% of their household income on rent.

According to the ACS 5-Year Estimates, in the three counties there are trends that a significant number of renters are spending greater than 30% of their household income on rent or housing, signifying that these households are cost-burdened. A significant portion of these households are spending greater than 50% of their household income on rent or housing costs which places them in the category of extremely cost-burdened.[122]

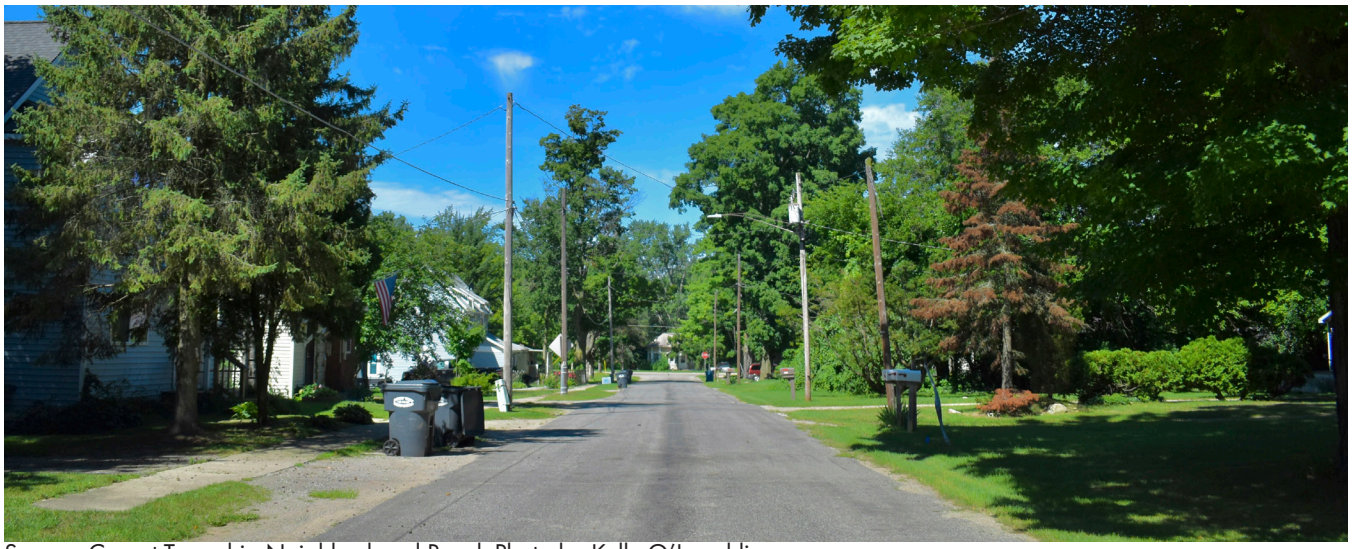
Housing Supply Analysis: Prevalence of Second Homes

Estimates nationwide suggest that all three counties in the Tri-County area have 10%-20% of their total housing units allocated to second homes.[123] However, it is well known by realtors and community members that the number of second homes makes up a higher-than-normal proportion of the housing stock, especially along the coast of Lake Michigan.

Second homes can pressure the housing stock because it adds to the demand for single-family housing and increases housing costs.

Housing Supply Analysis: Low-Income Housing Tax Credit Properties

The Low-Income Housing Tax Credit (LIHTC) program can help alleviate the growing concern of lower-earning households and the limited affordable housing supply. According to PolicyMap LIHTC data, as of 2019 there were 693 total affordable units located in properties enrolled in the LIHTC program in VBC. Of these units, 156 will have been enrolled in the program for 30 years by the end of 2022. This means that they are generally no longer obligated to adhere to income or affordability requirements. An additional 104 units will reach year 30 within the next 10 years. This would leave VBC with a severe deficit in affordable housing units during a time of larger demand for affordable units.



Source: Covert Township Neighborhood Road, Photo by Kelly O'Laughlin

Demographic Changes

The job loss and increase of retirees due to the PNPP closure will impact the demographics and earnings within the Tri-County area. These factors could impact property values, housing supply, neighborhood character, and family dynamics. Many of the jobs that PNPP provided are likely to be some of the highest-paying jobs in the area. These PNPP employees are likely to be the primary income earner for their households. Therefore, primary income earners will presumably find employment elsewhere which could lead to longer commutes or entire families moving away from the area.[124]

The Tri-County area is already experiencing a trend of young adults moving away for higher education or jobs.[125] The closure of PNPP and the loss of high-paying jobs will continue to exacerbate worker retention issues, thus leaving the Tri-County area with an already increasingly aging community profile.[126] This will also lead to a decreased supply of young workers, decreased demand for housing, and increased demand for healthcare. The lack of skilled young workers may also decrease the attractiveness of the area for new startups looking to enter the region.[127]

This loss in population of all ages will not be an immediately noticeable change in southwest Michigan. It may happen over a long period and due to the many factors that influence the decision to move. However, if a large number of households move away, there will be an increased supply of housing which could decrease property values.[128] Additionally, this population loss could put an additional strain on local businesses or employees, which has the potential to decrease job opportunities, tighten household budgets, and increase the already high demand for affordable housing.

Long Term Considerations

The combination of people moving away, housing attainability, and waves of economic impacts from the closure of PNPP will create overall economic stress on communities. Out migration and a decreased ability to invest in housing quality can affect neighborhood character over time. However, this overall economic shock will impact lower-income households the most. These impacts can compound and may lead to blighted or unattended properties.

4.4 ENVIRONMENTAL & HEALTH IMPACTS

4.4.1 ENVIRONMENT & SUSTAINABILITY

Background

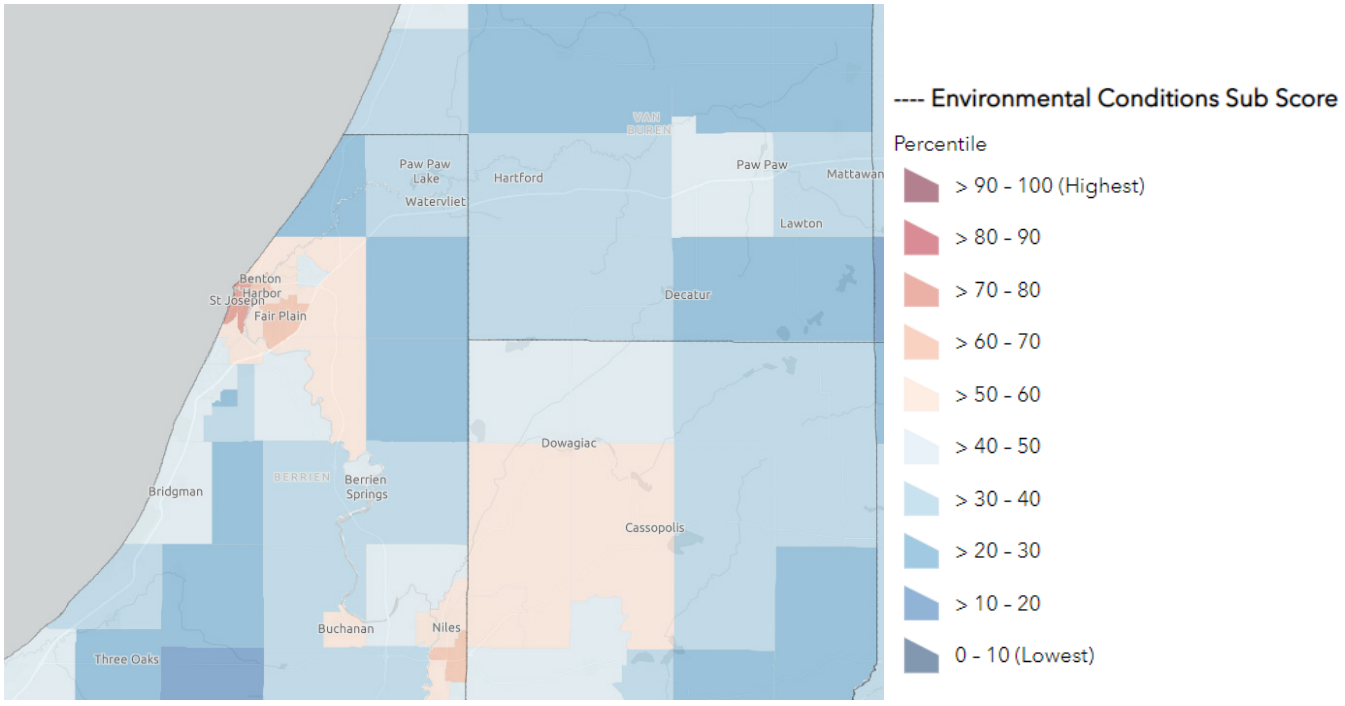
With more nuclear reactors set to decommission within the upcoming years, there must be a strong focus on the environmental impacts of decommissioning.[129] Despite monitoring by government regulatory agencies such as the Nuclear Regulatory Commission (NRC) and Federal Emergency Management Agency (FEMA) through the operation, licensing, and decommissioning processes, accidents can still occur, resulting in a significant environmental impact. Dismantling nuclear power plants can pose important risks to local ecology, people, and communities.

Environmental impacts and sustainability can be defined in many ways. The Environmental Protection Agency (EPA) defines sustainability "on a simple principle: everything that is needed for survival and well-being depends, either directly or indirectly, on the natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations."[130]

According to the Risk-Screening Environmental Indicators (RSEI) model, Michigan's environmental risk score is 135,220,573, which is in the middle range compared to EPA Region 5.[131]

According to the MIEJScreen, the Tri-County area environmental conditions sub-scores differ from county to county. The environmental conditions sub-scores include exposure indicators and environmental effects indicators. The lower the percentile the more desirable the environmental conditions are. The census tract which contains the site of the PNPP in VBC is within the environmental conditions 31st percentile. The areas immediately surrounding all range within the 10th to 50th percentile.[132]

Figure 10. Tri-County Environmental Conditions



Source: Tri-County Environmental Conditions, Map by Carmen Wagner from EGLE, "MiEJScreen DRAFT"[133]

There are higher indicators of poorer environmental conditions in the areas surrounding Benton Harbor and St Joseph in Berrien County. The same is true for areas surrounding Niles and Milton in both Cass and Berrien Counties.

Impacts & Assessment

Infrastructure developments for different components of plant operation can change the natural landscape of the site locations. The presence of a power plant has an impact on the physical landscape, as many power plants require land use conversion. In addition, they require access to roads, railroads, pipelines, transmission lines, and access to water for cooling.[134] As a result, during decommissioning processes, the established infrastructure can create a barrier to land reuse. The established land use of the power plant can make it difficult for others to buy or repurpose the land.

The presence of a power plant can also negatively affect the value of the nearby land plots. Since the energy creation process involves burning fuels–either fossil fuel, biomass, or nuclear fission reactions–to create steam that is necessary to move energy-creating turbines. The by-products of fuel burning can create air pollutants. In addition, there are a variety of waste products that can be produced that must be disposed of. This presence of waste also devalues the surrounding environment and land plots.

Power plants can also create an impact on surrounding water infrastructure since large amounts of water are needed to create steam. In Michigan, nuclear power plants are typically located near large bodies of water. In some cases, the water must be discharged from the plant after it has been used. This can create a change to the natural water's temperature and result in higher levels of pollutants in the water surrounding the power plant. These impacts can create issues in land reuse.[135]

Nuclear Risks to Environment

Nuclear power generation does not directly create carbon dioxide emissions, which minimizes the environmental risks associated with rising levels of greenhouse gasses. However, mining and refining processes for uranium ore, which is needed as the reactor fuel source, can require large amounts of energy to manufacture.

Source: PNPP Shoreline, Photo by Kelly O'Laughlin

The processes may involve fossil fuel emissions from uranium mining and milling from energy, water, and chemical consumption. Studies have indicated that the environmental costs of mining and milling uranium are highly dependent on the ore grade or the concentration of uranium. Heavily concentrated and richer deposits of rock typically consume few resources.

The main concern with nuclear energy, especially within the decommissioning context, is the radioactive waste substances and materials and spent fuel management. After being used in nuclear energy creation, by-products and waste materials can remain radioactive and have long-term environmental and health implications. As a result, the United States regulates nuclear plants through the U.S. Nuclear Regulatory Commission (NRC).

Radiation

Radiation is a source of energy and a natural part of the environment. There are three sources of natural background radiation: cosmic, terrestrial, and internal radiation.[136]

- Cosmic radiation comes from the sun and stars in the universe, which are continuously emitting radiation on the Earth.
- Terrestrial radiation comes from the Earth itself since radioactive materials like uranium, thorium, and radium naturally exist in Earth's soil and rocks. In addition, air and water contain small amounts of radioactive material.
- Internal radiation comes from radioactive potassium-40 and carbon-14, which exist in human bodies from birth.

In the United States, the average exposure to natural radiation sources is 300 millirems per year at sea level.[137] Man-made sources can contribute to higher than normal levels of radiation, especially with nuclear power generation.

Radiation is energy that has an electric field and magnetic field associated with it and has wave-like properties. There is a wide range of electromagnetic radiation in nature such as visible light. Ultraviolet radiation, x-rays, and gamma rays are radiation with the highest energy. When x-rays and gamma rays interact with atoms, they can remove electrons and create an ionized atom.

Ionized atoms are considered radioactive as they are an unstable blend of protons and neutrons. This radioactivity is the spontaneous emission of energy from an unstable atom to get to a more stable state. This is what creates the energy that is used in nuclear power creation. There are 4 types of ionizing radiation that are the by-products of radioactive atoms including alpha particles, beta particles, gamma rays, and neutrons.[138]

Types of Nuclear Wastes

Although nuclear waste's radioactivity decays over time, there are varying radioactive half-lives. Materials with shorter half-lives can be temporarily stored to reduce exposure. Waste management for materials with higher half-lives is cause for more concern in radiological exposure. All radioactive waste over time will decay naturally. Once it has decayed sufficiently the waste is no longer considered to be hazardous, however, in the immediate presence of higher radioactive material, there can be an environmental risk.[139]

There are five categories of radioactive waste as defined by the EPA including high-level waste, transuranic waste, uranium or thorium mill tailings, low-level waste, and technologically enhanced naturally-occurring radioactive material (TENORM).[140] Most of the waste, by volume, created in nuclear energy power creation is considered to have a low level of radioactivity.

High-level waste includes nuclear fuel from reactors and waste generated from the reprocessing of spent nuclear fuel. This spent fuel that is no longer used in producing electricity is stored as "rods" in small fuel pellets in long metal tubes. The depleted fuel is typically stored at the site where the waste is produced.[141] For PNPP, the spent fuel rods will be stored at the facility. The NRC provides guidelines about decommissioning and spent fuel management which is explained in detail within section 3.6 Safety Requirements and Implications.

Types of Radioactive Contamination and Environmental Implications

There are two main types of radioactive contamination that can occur. The first is internal contamination when people or animals internally absorb radionuclides through breathing, swallowing, open wound exposure, or skin absorption. The other type is radioactive contamination which can occur when radioactive material is deposited on or in an object or person. These hazardous materials can create implications for air, water, surfaces, soil, plants, buildings, animals, and humans to become contaminated.[142]

Exposure to radioactive levels from an atomic incident can cause immediate health impacts like burns and acute radiation syndrome or "radiation sickness." It also can result in long-term implications such as cardiovascular disease and cancer. These health impacts are an immediate concern when it comes to radiological release from power plants. Low levels of radiation in the environment do not cause immediate health risks but are a minor contributor to overall cancer risk.[143]

For radiological exposure there is concern for the long-term impacts, especially on the ecological health of an area. Power plant sites can retain levels of radioactivity, especially with the presence of radioactive waste on-site. However, rigorous monitoring by the NRC remains until the site fully decommissions.[144]

Nuclear Disasters and Environmental Concerns

Nuclear disasters are a large concern for areas that house nuclear power plants. The Tri-County area is particularly vulnerable due to the presence of two nuclear power plants.

Past nuclear disasters have created concern for nuclear energy. Incidents such as Chernobyl, the Three Mile Island Incident, and Fukushima have caused concern. The most recent large-scale disaster in Fukushima in 2011 resulted from an earthquake causing a reactor accident that caused the release of radioactive materials into the atmosphere.[145] These radionuclides spread across the Japanese environment, including land and sea. There were indicators of high levels of contamination in Fukushima and lower levels outside of Japan.[146]

In 1979, the most serious nuclear incident in the United States occurred at Three Mile Island due to a malfunction of the power plant's cooling circulation.[147] This partial meltdown caused concern for a negative impact on the immediate surrounding environment. Close environmental monitoring indicated very low levels of radiological releases and ultimately it was determined that there were no indicators of a severe long-term impact.[148]

These incidents caused a very negative public reaction to nuclear power plants since there were high risks of radionuclide releases, and radiation contamination is linked to negative health effects. It was noted that there is local public concern about the lasting environmental impacts that can affect the health of humans, plants, and animals in an affected region.

United States Nuclear Risk: Michigan Operating Nuclear Power Plants

Michigan currently has two other nuclear power plants besides PNPP: the Enrico Fermi 2 Power Plant located in southeast Michigan in Monroe County and the Donald C. Cook Nuclear Power Plant located in southwest Michigan in Berrien County.[149]

As a result of having two active power plants, the areas surrounding are more vulnerable to nuclear exposure in the event of a nuclear disaster. Fermi 2 is located in southeast Michigan and emergency preparedness would impact Monroe and Wayne counties. The D.C. Cook power plant is located in Berrien County. Currently, there is no cause for concern of nuclear or radiological exposure risk.

Holtec's Decommissioning Strategy

There are two main types of decommissioning strategies, DECON and SAFSTOR (more outlined in the safety and implications section). Holtec has not publicly stated which long-term methodology it will be implementing.

As of September 9, 2022, Michigan Governor Gretchen Whitmer announced a joint plan with Holtec to reopen PNPP.[150] In July 2022, Holtec with Whitmer's support applied for funding under the US Department of Energy's Civil Nuclear Credit (CNC) Program. However, in November the funding request had been denied. As of April 2023, Holtec submitted an application to the Department of Energy Loan's Program Office for financial assistance to revive PNPP.[151]

This statement influences the type of decommissioning strategy that Holtec will implement. As of right now, the spent fuel is remaining on the PNPP campus. This spent fuel keeps the radioactive waste hazards in the community. However, there can be issues with the environmental impact of transporting spent fuel that has not decayed enough. The decision to keep nuclear waste at the plant allows for some natural decay to occur over time and also allows for waste infrastructure to advance so that future waste management technology can be potentially used. This action is consistent with Big Rock Point Nuclear Power Plant, which began the decommissioning process in 1997 and still holds nuclear waste on-site.

Land Use Considerations

The western shores of Michigan, located along Lake Michigan, hold the world's largest freshwater sand dunes. Since PNPP is located in a unique landscape, there was public interest in the preservation, conservation, and potential restoration of the area.

Conservation efforts have been considered and are in discussion. As the future of Holtec and PNPP will be determined by the application for the DOE loan program, there are currently no active plans for the site to be turned back into a public-access natural landscape.

Big Rock Point Nuclear Power Plant, was a nuclear power plant that began the decommissioning process in 1997. Big Rock Point Nuclear Power Plant is located on the shores of Lake Michigan in Charlevoix, MI. This site still hosts nuclear waste. However, the area has been approved for public use since 2007 (approximately 20 years after the decommissioning process began).[152] PNPP is similar to Big Rock Point Nuclear Power Plant in the way that they are located along the Great Lakes shoreline on Lake Michigan. They could also potentially share the public use approval outcome, which is a desired outcome by conservationists.

Energy Demand Substitution and Fossil Fuels

A large consideration of the closure of a nuclear power plant is the impact on the environment from the displacement of energy sources. Since nuclear power is a low-carbon energy source, when decommissioned the energy demand is substituted from alternative sources. The current status of the energy markets means this is likely going to be substituted from fossil fuel-emitting sources. Since the discovery of shale fracking, natural gas production has increased in the United States and decreased energy prices. Although this is a cleaner source than traditional fossil fuels like oil and coal, there is still an increase in carbon output from natural gas energy production as compared to nuclear low carbon output. This is an environmental implication to consider in the transition away from nuclear power plants.

Alternatives and Clean Energy

Although nuclear power is a low-carbon energy solution, there is still a harmful byproduct that results in energy creation. As environmental policy goals seek lower carbon output, there has been an increase in demand for cleaner energy sources like solar and wind to help the displacement in energy production.

It is unlikely that the site that hosted PNPP would be able to accommodate a wind and solar energy farm due to the vast land quantity needed for a high level of production. However, there is solar energy potential in southwest Michigan. Cass County has a utility-scale solar farm that currently supports some capacity demand. The facility, situated on roughly 1,000 acres of land, is expected to begin construction in the spring of 2023 and will create an estimated 350 construction jobs for the area.[153]

Additionally, PJM, the ISO that services VBC is taking steps in anticipation of the energy transition away from fossil fuel sources. PJM has stated intentions of expanding its renewable energy sources, and is particularly targeting off-shore wind facilities near New Jersey.[154] This is a trend that many energy utilities and stakeholders are looking towards that can help offset the need for fossil fuel emitting power generating sources.

4.4.2 ENVIRONMENTAL JUSTICE

Introduction

While nuclear power is a fairly clean source of energy, many of the aging power plants require heavy investments in infrastructure. As changes in energy sources occur due to decarbonization and the decommissioning of older power plants, it's key to focus on "just transitions". A just transition focuses on greening the economy in a way that is as fair and inclusive as possible to everybody concerned, creating decent work opportunities and leaving no one behind.[155] Power plant closures impact host communities' environmental, economic, and socio-economic systems. Despite the growing need for climate change mitigation, many low-income, marginalized communities are economically reliant on power plants. As a result, there is a need for environmental justice (EJ) considerations in the decommissioning and economic recovery process.

Background

Environmental injustice occurs when exposures to pollution and other environmental risks are disproportionately distributed by class, race, and ethnicity. To avoid or fight these injustices, the EPA has defined environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences

resulting from industrial, governmental, and commercial operations or policies. Meaningful involvement means people have an opportunity to participate in decisions about activities that may affect their environment and/or health."[156]

A study on nuclear power and environmental justice issues identified three main types of environmental justice: distributive, procedural, and recognition.[157] Distributive justice is how environmental burdens are socio-spatially distributed, and what principles are used in allocating risks. Procedural justice is how equitable or inequitable the processes are whereby decisions are made regarding the imposition of environmental risks on people and places. Recognition justice concerns who is or is not recognized as worthy of inclusion in decision-making regarding the allocation of hazard burdens.[158] This is important in considering the environmental and health impacts of day-to-day use of the plant while operating, and the environmental and health impacts of decommissioning activities.

Environmental Justice & Nuclear Power Plants

A study looking at distributive justice and all operating nuclear plants in the United States (99 operational reactors at 61 sites) found that more white people live outside Emergency Planning Zones (EPZs) than inside (75% vs 71%).[159] Furthermore, a larger percentage of African Americans live within the 50-mile zone than outside it (17% vs. 10%), with similar findings for other racial groups. Populations near NPPs face health risks associated with potential exposure to low-level routine radioactive effluents emitted from plants. This is also a consideration during the decommissioning process, as there is always a potential risk of catastrophe or leak (however small), and this will affect the people nearest the plants most, which are typically more marginalized communities.

Key procedural justice issues with nuclear power include plant site selection, emergency preparedness capabilities, and public participation in nuclear power plant license renewal procedures.[160] Concerning nuclear plant decommissioning, emergency preparedness capabilities and public participation in the decommissioning process are most relevant.

Recognition Justice in relation to nuclear plants is particularly salient in Indigenous communities, as they are not typically considered in any decision-making process.[161] The primary concern of activists, tribes, and communities opposing nuclear waste geologic burial sites is the sheer volume of nuclear waste that traverses highways and railways through population centers in transit from nuclear reactors and weapons sites. Where high-level radioactive waste will be stored (whether at a commercial reactor site or moved to permanent storage) are typically areas where Indigenous communities live.

Background of Covert Township, MI

Covert Township, MI, where PNPP is located, has a unique racial history that helps explain the diversity of the area.[162] In the 1860s, both White and Black people settled in the area in pursuit of equality.

Despite nationwide segregation through Jim Crow legislation, citizens of Covert Township disregarded these laws and lived an integrated life. Despite the growth and transition from logging to farming, the area remains diverse and equal, with a growing population of Hispanics and Latinos today.

Benton Harbor Water Crisis

One major environmental injustice happening just 18 miles south of PNPP is the Benton Harbor Water Crisis.[163] This lead contamination crisis, similar to the Flint Water Crisis, is affecting a

majority Black city, but it is not receiving as much media attention as Flint. This crisis has been ongoing since 2018, and funding for lead pipe replacement is just now starting to arrive. Benton Harbor is also within the 50-mile EPZs of both PNPP and Cook Power Plant, making it especially vulnerable to any nuclear disruption that may occur at either plant.

Environmental Justice in VBC

Using MIEJScreen, the three census tracts closest to PNPP have an overall environmental justice score, based on environmental exposure, environmental effects, sensitive populations, and socioeconomic factors, above the 59th percentile.[164] This means that these areas are at a higher risk of environmental injustices than a majority of Michigan, as they experience higher pollution burden and vulnerability than census tracts with lower scores. A deeper breakdown of the MIEJScreen criteria is seen in Table 28. A breakdown of the different EJ percentiles within these three census tracts is shown in Table 29.

Overall, it appears that these areas have a higher percentile of socioeconomic factor indicators and sensitive population indicators to contribute to the higher population characteristic indicators, while the environmental condition indicators are much smaller. So, the MiEJScreen score is higher primarily because of these population characteristics.

Impacts and Assessment: Environmental Justice & PNPP

While there are no current environmental injustices directly related to the plant, there is always a risk due to the aforementioned economic and environmental impacts to be made during the decommissioning of PNPP. There are environmental distributive justice

Table 28. Breakdown of MiEJScreen score factors

Categories	Environmental Exposure	Environmental Effects	Sensitive Populations	Socioeconomic Factors
Indicators	• NATA* Air Toxics Cancer Risk • NATA Respiratory Hazard Index • NATA Diesel • Particulate Matter • Particulate Matter ($PM_{2.5}$) • Ozone • Traffic Density	• Proximity to Cleanup Sites • Proximity to Hazardous Waste Facilities • Impaired Water Bodies • Proximity to Solid waste Sites and Facilities • Lead Paint Indicator • Proximity to RMP Sites • Wastewater Discharge Indicator	• Asthma • Cardiovascular Disease • Low Birth Weight Infants • Blood Lead Level • Life Expectancy	• Low Income Population • Black, Indigenous, People of Color Population • Educational Attainment • Linguistic Isolation • Population Under Age 5 • Population over Age 64 • Unemployment • Housing Burden
Sub Scores	**Environmental Conditions** (Average percentile of Environmental Exposure indicators + 0.5 x average percentile of Environmental Effects indicators) 1.5		**Population Characteristics** (Average percentile of Sensitive Population indicators + average percentile of Socioeconomic Factor indicators) 2	
Score	Final Composite Score = Environmental Conditions score x Population Characteristics score **MiEJScreen Score**			

Source: Breakdown of Mi EJScreen Score Factors, Format by Carmen Wagner from EGLE[165]

*National Scale Air Toxics Assessment (NATA)

Table 29. Breakdown of EJ percentiles in the three census tracts closest to PNPP

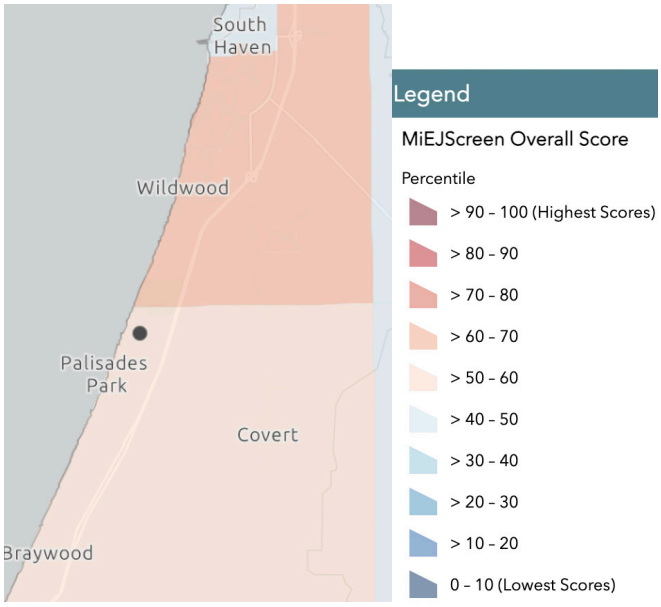
Census Tract	26159010600	26159010500	26159010400
MiEJ Score	59	63	61
Environmental Conditions	31	48	46
Exposure Percentile	31	40	38
Environmental Effects Percentile	38	75	75
Population Characteristics	79	70	68
Sensitive Populations	65	48	52
Socioeconomic Factors	96	88	81

Source: EJ Percentiles near PNPP, Format by Carmen Wagner from EGLE[167]

considerations to be made due to the inherent risk of nuclear energy and the socioeconomic and demographic makeup of many of the areas surrounding PNPP. These lower-income, marginalized communities will automatically be most affected if a nuclear catastrophe, or other environmental issue, occurs.

There is a mix of academic research on the impacts of any radiation exposure, as mentioned in section 4.4.1 Environment and Sustainability. To monitor any impacts, The State of Michigan's Department of Environment, Great Lakes,

Figure 11. MiEJScreen Map of EJ Scores Near PNPP



*Black dot = Palisades Nuclear Power Plant
Source: Mi EJScreen Map near PNPP, Map by Carmen Wagner from EGLE MiEJScreen[166]

and Energy (EGLE) has been monitoring potential impacts on air, dairy, water, and more around the plant since it opened to assure public safety, and this will continue during the decommissioning process.

Covert Township, where PNPP is directly located, as well as Hartford, Bangor, and Lawrence are all areas of concern due to their higher level of marginalized and low-income residents compared to the rest of the county and state of Michigan. Covert Township can be seen in Figure 11. Risks will continue to decrease as the fuel is cooled during the decommissioning process. There are community concerns about waste storage and transportation of waste in the future, but these are safely regulated and are unlikely to cause any harm. Local, state, and federal authorities are alert to any potential risks that could occur at the plant. Any environmental issue that occurs at the plant, while unlikely, will result in an environmental injustice that will harm the marginalized communities near PNPP the most.

Concerning procedural justice, emergency preparedness capabilities near the plant are strong, but some local authority funding will be lost with the plant as the decommissioning process starts. More about emergency preparedness is explained in section 4.5 Safety Requirements and Implications. Public participation is crucial to the decommissioning

process and is currently done through the Palisades Community Advisory Panel (PCAP).[168] According to the PCAP web page, "The purpose of the Palisades Community Advisory Panel (PCAP) is defined by the panel's charter, which states that the PCAP's purpose is twofold:

1. To provide for open communication, public involvement, and education on issues related to the PNPP shutdown and decommissioning.
2. To evaluate and comment upon data and other information which may include (1) publicly available information regarding the balance of the PNPP decommissioning trust fund; (2) the status of decommissioning activities; (3) filings submitted to the U.S. Nuclear Regulatory Commission (NRC); and (4) and information provided by the Palisades Economic Recovery Initiative."[169]

PCAP meetings are very important for public feedback and engagement, and engagement with the local community is one of the most important aspects of the decommissioning process. Keeping people informed and engaged should be a priority of the decommissioning process so that they can make informed decisions and reduce fear of the plant's decommissioning.

Pokagon Band of the Potawatomi's Concerns and Recognition

The Pokagon Band of the Potawatomi is located in close proximity to the plant. The Pokagon Band of the Potawatomi is concerned with the potential for contamination and making sure that all proper procedures are in place and being followed to reduce the probability of a disaster which could have long lasting effects on the area. The Pokagon Band of the Potawatomi has tribal lands, gaming, and housing within 10 miles of PNPP, so they are concerned about the timeliness of information getting to the tribal community if something were to happen.

The Pokagon Band of the Potawatomi has a member on the PCAP who has attended several meetings regarding the decommissioning. They listen to updates on PNPP, but unfortunately there is no formal process regarding decisions making from the tribal perspective. being made and the tribal perspective.[170]

One concern of many indigenous groups outside southwest Michigan is the transportation of waste to an off-site location due to the high likelihood that that location is where indigenous groups live. Another is keeping that waste on-site and the potential risks of that for Lake Michigan and the surrounding environment.

Justice40 Considerations

Justice40 is an executive order from President Biden which plans "to deliver at least 40 percent of the overall benefits from Federal investments in climate and clean energy to disadvantaged communities."[171] The U.S. Department of Energy (DOE) has 146 programs that will be covered under Justice40, and The Office of Nuclear Energy under the DOE has 8 programs covered under Justice40 which signifies things to come related to environmental justice and nuclear power.[172]

4.5 SAFETY REQUIREMENTS & IMPLICATIONS

Background

Safety is the key to nuclear power plants and the decommissioning process, and is related to all pieces of this assessment. The Nuclear Regulatory Commission (NRC) has decommissioning guidance and rules that have to be followed, and this includes safety regulations. According to the NRC, "the facility must be decommissioned by safely removing it from service and reducing residual

radioactivity to a level that permits release of the property and termination of the operating license."[173] They have strict rules governing plant decommissioning that involves removal of radioactive fuel and cleanup of radioactively contaminated plant structures and systems. These safety requirements aim to protect the public and workers throughout the decommissioning process.

The NRC's detailed plans are summarized on their website: "Decommissioning program activities include

1. developing regulations and guidance to assist staff and the regulated community;
2. conducting research to develop data, techniques, and models used to assess public exposure from the release of radioactive material resulting from site decommissioning;
3. reviewing and approving decommissioning plans (DPs) and license termination plans (LTPs);
4. reviewing and approving license amendment requests for decommissioning facilities;
5. inspecting licensed and non-licensed facilities undergoing decommissioning;
6. developing environmental assessments (EAs) and environmental impact statements (EISs) to support the NRC's reviews of decommissioning activities;
7. reviewing and approving final site status survey reports; and
8. conducting confirmatory surveys."[174]

NRC Safety Inspections

The NRC was responsible for multiple inspection procedures which were put in place immediately and continued until the site was fully decommissioned.[175] Decommissioning Inspector Rhex Edwards, presented on the process and inspections during the March 2022 PCAP meeting. The Environmental Monitoring Inspection Procedure included sampling and analysis of radioactive release paths, ensuring environmental monitoring programs are consistent with the license requirements, and monitoring implementation of the Ground Water Protection Initiative. The Radioactive Waste Management and Transportation Inspection procedure verified the effectiveness of the licensee's programs for the handling, processing, storage, and transportation of radioactive material and waste. The Decommissioning Performance and Status Inspection Procedure evaluates the decommissioning status and compliance with regulations, maintains awareness of work conduct, evaluates staffing, training, and qualifications, and documents any impacts to the decommissioning financial assurance.

Decommissioning Strategies

The decommissioning strategy decision will have an impact on safety. There are two main strategies: DECON and SAFSTOR (see Table 30).[176] DECON, or immediate dismantling, occurs soon after the nuclear facility closes, and involves removal and decontamination of equipment, structures, and portions of the facility containing radioactive contaminants to a level that allows release of the property and termination of the NRC license. SAFSTOR, or deferred dismantling, is when a nuclear facility is maintained and monitored in a condition that lets the radioactivity decay until the plant can be dismantled and decontaminated. A combination of the two is also possible. Each has their own safety pros and cons, but safety regulations should be followed in all cases.

Emergency Preparedness

Emergency preparedness is essential given the potential threat of a nuclear accident. There is a 2-mile radius around the plant that is for evacuation in an emergency, and a 5-mile zone downwind of the projected release path.[178] There are also 10- and 50-mile emergency

preparedness zones (EPZs) around a plant that are put in place as part of a plant's preplanned protective action strategy. The 10-mile radius is a plume exposure pathway, where protective action plans are designed to avoid or reduce doses from potential exposures, such as to radioactive particles. The 50-mile radius is an ingestion exposure pathway, where protective action plans are designed to avoid or reduce dose from drinking or eating radioactive materials.

There is also an Emergency Preparedness Brochure for PNPP shared with Allegan, Berrien, and Van Buren Counties.[179] This brochure outlines an action plan for residents if an emergency happened at the plant. According to local emergency preparedness managers, this brochure will likely remain in effect during the decommissioning process, although it may change slightly as Holtec takes over decision making.

Many things will change related to emergency preparedness during the decommissioning process. According to interviews with local emergency preparedness experts, less emergency training is needed by local authorities now that the plant has been sold and is starting the decommissioning process.[180] Previously, training would happen multiple times a year to exercise and deploy teams to perform services that will happen in the time of an emergency. They would also perform these exercises every 2 years in front of FEMA, although this will no longer take place.

Table 30. *DECON vs. SAFSTOR Decommissioning Strategies*

	DECON - Immediate Dismantling	SAFSTOR - Deferred Dismantling
Technical	Removes radioactive waste hazards to community Takes advantage of existing best management practices Must account for transportation of hazardous materials	Radioactive decay reduces hazards to workers Allows for advances in decommissioning technology Must account for the long-term presence of hazardous materials
Economic	Significant up-front costs can be discounted over long term Avoids uncertainty of future market conditions, inflation, and potential natural disasters	Project cost and complexity lowered as radioactivity decays Allows decommissioning fund to grow substantially between closure and dismantling
Social	Allows for site reuse without stagnation Site remains active in immediate aftermath of closure, transmitting active-use benefits to the region	Allows more infrastructure to remain after cleanup Avoids public opposition associated with transportation for off-site disposal
Ownership	Public utilities can spread costs among ratepayers over the long term	Investor-owned utilities can secure shareholder confidence by deferring costs

Source: The Pilgrim Nuclear Power Station Study: A Socioeconomic Analysis and Closure Transition Guide Book[177]

Impacts on Local Authorities

Local authorities will be impacted by PNPP closing strategically and economically. For example, the Covert Township police department and fire department are no longer going to be supported by the revenue and tax base from Entergy producing energy. This will likely have impacts on their employment and training. Additionally, other local departments will likely be affected similarly.

The off-site response and preparation of these local authorities will be lessened since they will not do training and exercises, nor maintain the resources they would have when the plant was operating at full capacity. However, they are still alert to PNPP and will continue to monitor any potential risks, especially with the nearby Cook Power Plant still in operation.

Community Safety Concerns

Community members have raised concerns about fuel and waste storage and transportation during PCAP meetings. The NRC is responsible for safety guidelines and has extensive decommissioning rules and regulations that Holtec and local authorities are following. There is always the potential for a catastrophe, but that is very unlikely. According to Rockey Adams from the Berrien County Emergency Management, the following are all safety considerations of the plant, although all safety measures at the site will be followed and emergency management offices are in contact with Holtec:

- Short term risk of Zirconium metal release while plant is cooling the fuel rods
- Long-term storage of the fuel rods and where that will be located (this is a national problem) – Storage casts are very robust and the risk is low to minimum
- Long-term transportation route possibilities
- Waste materials (will not know the extent of that risk until Holtec starts the site evaluation)

All safety measures at the site will be followed closely and local and state emergency management offices are in contact with Holtec about these considerations.

Source: Covert Township Public Works, Photo by Kelly O'Laughlin

Decommissioning & Transportation

A large component of the decommissioning processes will require transportation services for the removal and disposal of asbestos, universal hazardous waste, and low-level radioactive waste (LLRW) from PNPP. This will include different forms of transportation and transportation supportive services–specifically truck, rail, and transloading facilities. The economic impact of transportation services needed for decommissioning will be based on the number of shipments needed to go to and from PNPP, the amount of hazardous waste, and the pre-decommissioning plans from Holtec.

First, a site inspection will be performed to determine the amount of asbestos, universal hazardous waste, and LLRW. The asbestos and universal hazardous waste will be removed before the radioactive waste is addressed. The asbestos and universal hazardous waste will be packaged in containers and then transported to treatment, storage, and disposal facilities.

Most of the radioactive waste within PNPP will likely be LLRW.[181] LLRW will be transported to the proper LLRW disposal facilities. The only LLRW management facilities within the US to accept LLRW waste from Michigan are Waste Control Specialists (WCS), LLC located around Andrews, Texas and/or Energy Solutions Clive Operations in Clive, Utah.[182] The exact economic impact of this work will be determined by future decommissioning decisions from Holtec.

Moving radioactive waste is required to be contained properly by the NRC. This creates an opportunity for jobs and profits for certified transportation companies because hauling radioactive waste creates higher marginal profit opportunities. There are higher profit margins due to the additional requirements for radioactive waste hauling certifications and security services provided.

Holtec Decommissioning at Oyster Creek

Instances have occurred where Holtec has had safety issues at other decommissioning sites, including worker safety issues and an accident that caused a large power outage around a site.[183] Holtec began the decommissioning process at Oyster Creek in 2019 and regulators documented at least nine violations of federal rules, including contaminated water, falsified inspection reports, and other security lapses.[184] These issues all threaten the safety of workers and areas surrounding the plant.

Source: Palisades Power Plant in Covert, Photo by Chris DuMond, Special to the Detroit News Accessed: July 12, 2023, https://www.detroitnews.com/story/news/environment/2022/04/20/gov-whitmer-applies-aid-stop-closure-palisades-nuclear-plant/7379432001/

5 CONCLUSION: KEY TAKEAWAYS & OPPORTUNITIES FOR MITIGATION

CONCLUSION

This assessment presents a high-level understanding as a first step for the Tri-County communities to initiate an economic recovery strategy. This understanding is meant to empower communities to plan realistically for future economic and community development. It equips locals with the knowledge to work toward economic stability and possibly transformation. The impacts of the closure includes job losses, a loss in the local tax base, declines in the local supply chain and retail, and lower revenues. To help plan for a sustainable future economy, the assessment also presents how these impacts ripple across the local and regional economies.

The conclusion provides insights into the areas where planning can create development goals and actionable mitigation plans. The key takeaways highlight impacts and the opportunities for mitigation describe possible next steps for the next phase of the Palisades Economic Recovery Initiative: mitigation strategies. In the mitigation strategies phase a strategy team will be assembled with key stakeholders that are experts on the local systems. This strategy team will consist of leaders across planning, economic development, local and state government agencies, and local businesses. They will also collaborate to create a strategic plan consisting of priorities and objectives, and will identify essential resources and data to drive actionable projects for local and regional economic stability and growth.

The opportunities for mitigation also provide insights about how development can bridge the economic gaps by creating realistic goals and mitigation plans. Furthermore, the opportunities for mitigation identify some of the region's unique attributes and assets that offer opportunities to facilitate a fair and smooth economic transition.

5.1 KEY TAKEAWAYS & OPPORTUNITIES FOR MITI

Employment Services

Key Takeaways

There will likely be major indirect impacts of the PNPP closing on employment services in the Tri-County area. The major loss of jobs in the community (739 in the Tri-County area, according to Table 4) will impact local employment services that deal with recruiting, job searches, supplying contract workers, supplying human resources, and more for jobs at the plant.

The closing of PNPP will have a fairly small induced impact on employment services and workforce supply and development in VBC and the Tri-County area, according to IMPLAN. However, there will be a loss in workforce supply from workers and their families leaving the area, a loss in talent and children in schools which leads to a loss in the future workforce, and a loss of high technical skill sets from employees leaving.

A few major challenges to the employment services industry in southwest Michigan exist. It is a rural, remote community and has a lack of broadband internet access, which makes it a less attractive community to live in and hard to attract workforce supply.[185]

Opportunities for Mitigation

One opportunity for mitigating indirect impacts could include increasing real-time data and information, as change happens very quickly in the area.[186] Datasets and tools should also be put in the hands of people who could quickly share information with the rest of the business community (software, research, etc.).

One strategy for mitigating the induced impacts could include increasing the area's attractiveness through more accessible activities, services, and support systems. The area should create an environment that fosters entrepreneurship opportunities, increases internet broadband, and increases agriculture tourism.[187]

Furthermore, the area should provide alternative job and college opportunities through training and apprenticeships. The departure of young individuals for college as it contributes to the outflow of labor, poses a significant concern. There is a need for an alternative career development option that fits with the local population. This could include apprenticeships that would keep young people in the area, especially those who do not pursue higher education but may leave the area due to a lack of alternative job opportunities. To achieve this, there should be education in the employment services industry about how to build a workforce and leverage dollars to train and retain workers. Some examples of apprenticeships include brewers, winemakers, truck drivers, and machine-builders. Van Buren Tech offers over 25 career and technical education (CTE) programs, including 16 that offer college credit and 13 that offer national certification and licensing.[188] This could be an important resource for training and building a diverse workforce in VBC, resulting in an increase in the diversity of businesses within the manufacturing industry in the Tri-County area.

The Tri-County area could also work toward increasing manufacturing diversity by attracting new growing industries. For example, industries in cannabis and electric vehicles, which will likely become growing workforce areas.

Food and Beverage

Key Takeaways

The food and beverage industries will likely see negative impacts due to the loss of the PNPP as a major employer and customer(s). The largest impacts will be felt during the off-peak tourism season, especially from the loss of contract employees that came in off-tourism seasons every 18-24 months.

Tourism will continue to support the food and beverage industry. Though there will be impacts from stopping PNPP operations, the PNPP will not be fully closed until the decommissioning process is complete. This is not anticipated for another 10-20 years. In the meantime, scaled-back operations will continue, and food and beverage purchases will still be required. As a result, there will presumably be less food and beverage purchases in the region. However, the full magnitude of the effects will be unknown.

Opportunities for Mitigation

The negative impacts could be mitigated by ensuring the users of the future site continue to have strong relationships with the local food and beverage industries.

Additionally, the local food and beverage industry should be supported in order to continue modernizing their operations to improve their resiliency during the economic lull. For example, the food and beverage industry could be supported with internet-based resources like websites and new purchasing opportunities, resources to improve their delivery options, and investment opportunities to help market restaurants.

Retail

Key Takeaways

The general retail industry will be minimally impacted during the high tourism season.

However, the loss of a large regional retail purchaser like PNPP will have a larger impact. Specifically, specialized retailers will be the most vulnerable to economic losses.

Opportunities for Mitigation

The opportunities to mitigate the losses for the retail industry will depend on the future use of the PNPP site. If a new large employer is replaced at the PNPP site, a new and strong relationship with the local retailers would be important to develop.

The Tri-County area could support retailers, particularly highly specialized retailers, by providing opportunities and resources to help modernize their operations during the economic transition from nuclear power generation to the next site use.

Healthcare

Key Takeaways

According to IMPLAN, there will be little to no impact on employment and jobs in healthcare in VBC. However, there will be an impact on the output.

According to stakeholder interviews in the area, the actual economic impact of the closure on the healthcare industry is fairly small in VBC, although it may have more of an effect on the areas surrounding VBC, where many go to receive medical treatment.

Access to quality healthcare showed to be a major barrier for residents of VBC.[189] Closure of the PNPP will likely increase overall uncertainty, stress, and the social and economic disparities that already exist in VBC. One example of these disparities can be seen in the section 4.3 Housing and Community Impacts, which suggests that there is a rising cost burden of homeownership which may be difficult to surmount for lower-income households. This may lead to a higher-than-normal rate of people switching from homeownership to renting. The long-term impacts are uncertain at this point, but they should be monitored in the future.

Opportunities for Mitigation

To mitigate the impact on the healthcare system, the health of the community (including mental health) should be monitored.

There is an aging population in the area, which produces an increased demand for healthcare. The overall aging population will also be exacerbated as young people move away.[190] There is a growing need for healthcare services in the Tri-County area. Therefore, an important strategy to mitigate the negative impacts on healthcare includes increasing the amount and quality of healthcare services across VBC. This strategy is economically challenging because the healthcare environment is rapidly shifting and consolidating.

Another strategy for mitigating the impacts in VBC is to go all-in on the provision of telehealth. This would require more robust broadband infrastructure, consumer education on how to engage in telehealth, and a complementary investment by healthcare in their capacity to support telehealth.

Cost of Purchasing Electricity: Electric Power Transmission & Generation

Key Takeaways

The PNPP closure will not affect the cost of purchasing electricity in the Tri-County area. This is because Berrien and Cass counties are served primarily by Indiana Michigan Power Company with some cooperative and municipal utilities as well. VBC is served by Indiana Michigan Power, Consumers Energy, and some municipal utilities as well.

The energy produced by PNPP is technically used to serve Consumers Energy customers rather than the Tri-County area as a region. Therefore, any energy cost impacts from PNPP closure would be seen only by Consumers Energy customers.

Opportunities for Mitigation

In order to mitigate the impacts of energy costs and electric power generation the region should work to improve efficient energy use and support local energy production, especially renewable energy.

Energy efficiency programs can help incentivize more responsible energy use. These can be incentivized with financial rebates for the cost of an initial energy assessment, or by providing free or low-cost project counseling. However, rebates often work better than providing free services, which can diminish the perceived value. Additionally, rebates can often be bundled into program offerings. Limited time incentives could also support motivation and generate excitement to participate.

Local energy production could be supported by providing upfront financial incentives which can lower barriers to participation. Additionally, local businesses could be asked to support local energy production, such as renewable energy sources like solar or wind.

Utility companies can be asked to support both local energy efficiency programs and energy production which will help advance common goals. Utility companies can also be invited to support educational workshops about energy efficiency and commercial or residential renewable energy production.

The small, rural communities of the southwest Michigan region should be supported to work toward developing energy efficiency and energy production programs. To work directly with these communities, it is beneficial to be

aware of state demand-side management and renewable energy requirements. This information is a key motivator for utilities to work with local programs. Additionally, it would be important to coordinate collaboration between utility staff and community members to design a project that advances common goals and adds value.

Source: Photo by Entergy

Other Real Estate

Key Takeaways

"Other real estate" is made up of businesses primarily focused on performing real estate services, such as real estate escrow agencies, real estate listing services, and real estate fiduciaries' offices.

According to IMPLAN, the closure will have an indirect impact in the form of a loss of seven jobs in VBC and 17 in the Tri-County area. According to stakeholder interviews, real estate is likely to be more indirectly impacted in the short-run, and only for some developers/agencies.

According to IMPLAN, the closure will have an induced impact in the form of a loss of three jobs in VBC and seven jobs in the Tri-County area. If there is a loss of population and skill-set loss from the PNPP closure, then real estate may have a more difficult time filling empty retail and businesses.

Opportunities for Mitigation

The main way to mitigate impacts to other real estate is having local leadership that will manage the economic system and the competitiveness of the landscape. This would include developing a diverse economic system made up of different types of industries and businesses of diverse sizes in the area. Economic diversity which will strengthen the resilience of the local economy.

Additionally, it is typical for industrial systems to have specific business that support their operations. It is particularly helpful if this industrial support system can create a local closed loop system, meaning that the outputs of one industry supports a neighboring industrial site, and so on.

Economic diversity, specifically in the retail sector, will also be important to build because it adds to the attractiveness and vibrancy of the town. Local leaders could make the area a more attractive place to live by filling empty retail space, especially in downtown areas.

Other Local Government Enterprises

Key Takeaways

"Other local government enterprises" is a broad industry that is defined as organizations that operate like businesses but are owned by the government. Examples include waste management and remediation services, natural gas distribution, water and sewage.

The impacts upon this sector will be felt by the loss of the company that interacted with government enterprises. The effects from the PNPP closure on local government enterprises will be felt when residents of the area move out of the area. These effects will likely be small and gradual.

Opportunities for Mitigation

Government enterprise services have been necessary and will continue to be used as the PNPP site continues to decommission and slow down its operational activities.

Future forms of land use at the PNPP site can continue to use local government enterprise services. However, while the future use of the site is being determined, investments can be made to improve the process and technology for government enterprise services. This would provide resilience of these services during the economic lull of decommissioning, and it would increase the attractiveness of the area for new developments.

A mitigation strategy for the induced impacts would be to work to maintain or increase the number of residents in the area. Specifically, this could include incentives that encourage the impacted employees and existing residents from moving away. It would also be important to work toward growing the local community and attracting new residents to the region.

Good jobs typically attract new residents to an area and would encourage previously employed PNPP workers to stay in the area. When considering the future use of the PNPP site, there would be major economic benefits to attracting another large employer in the area.

Financial Services

Key Takeaways

There will be economic impacts as PNPP operations slow and halt, but PNPP will not be fully closed until the decommissioning process is complete. This is not anticipated until around the 2030s-2040s (in another 10-20 years). In the meantime, scaled back operations will continue and will include financial services. Since the continued operations means that financial services will continue to be needed, the full magnitude of the effects were unknown during the time of the assessment.

Effects from the PNPP closure on financial services will be felt if residents move from the area and if there is less income in the community to put towards financial services. These potential effects will be gradual.

Opportunities for Mitigation

The financial services sector will have employment and will continue to have employment as the site continues to decommission and ramp down its operational activities.

If there is a new employer or new usage for the site, this could provide protection from the long term financial services economic impact.

It will be important to maintain and/or increase the number of residents in the area. This means that it would be best if the impacted employees and other existing residents stayed in the area. Additionally, the best case scenario would be to retain the current population and to grow it by attracting new residents to the region. The potential to have another strong employer in the area would support this strategy by providing new available jobs to the region.

Truck Transportation

Key Takeaways

Large quantities of diverse materials were shipped to the plant for the upkeep of the building, offices, cafeteria, mechanical operations, landscaping, the backup diesel generator, and other plant operations. These purchases would arrive at the PNPP by truck, but some purchases may travel by multiple modes of transportation such as air, rail, water, and pipeline before reaching the plant. The majority of PNPP's transportation needs used trucking services for deliveries and hauling materials.[191] However, most of the economic impact will be on the wide category of transportation support activities. This includes, but is not limited to, support activities for air transportation, motor vehicle towing, and freight transportation arrangement.[192]

The amount of goods transported to the plant would double during the scheduled outages when contractors worked at the plant.[193] These influxes in purchases meant that they trickled down to support many transportation jobs.

Overall, the economic impact of the PNPP closure will likely be minimal to the transportation sector because the transportation sector tends to be highly flexible as they work on the margins of transport needs. Additionally, transportation services needed during decommissioning will provide jobs in that process.

Opportunities for Mitigation

The jobs lost for truck transportation for PNPP will likely be picked up elsewhere due to the flexible nature of trucking services.

However, the best method to mitigate any potential hardship would be to support, grow, and diversify businesses in the area. This could include tax incentives for businesses to stay open and for new businesses to come to the area. Truck transportation jobs thrive with a healthy economic system, which includes purchases and shipments.

Support Activities for Transportation

Key Takeaways

The vast majority of spending within transportation is within the "support activities for transportation" NAICS codes. This includes support activities for air, rail, water, and truck transportation.[194]

In 2020, $38,036,840 was spent for support activities in air, rail, water, and truck transportation.[195] The most was spent on freight transportation arrangements.[196]

Opportunities for Mitigation

The decommissioning process provides an opportunity for Holtec to hire transportation jobs and transportation support activity jobs. The businesses that worked to deliver and haul from PNPP should be identified and hired for the decommissioning process whenever possible.

Philanthropic

Key Takeaways

The VBC Intermediate School District (VBISD) programs have partially relied on the Entergy Foundation. There are some funds to continue into 2022. After that, VBISD will need alternative funding.[197]

United Way of Southwest Michigan stated that they may be able to locate funds from other sources.[198] During the time of the Economic Assessment, the giving campaigns from Holtec were uncertain.

Opportunities for Mitigation

In order to mitigate the impacts on the philanthropic sector, new businesses and younger generations will need to be engaged in monetary giving to local organizations. It is unclear how much Holtec will engage with local philanthropic and community efforts, but it would be important for Holtec to be involved in community development whenever possible.

There is also a need to engage new generations of local company owners with local NGOs and/or philanthropic services.

Scientific Research and Development Services

Key Takeaways

Research into nuclear energy advancement is predominantly done in national laboratories and academic universities, with some private sector activities occurring. Active power plants are seldom used in traditional research. Therefore, the scientific research and development services will be minimally impacted as PNPP was not a research reactor.

There may be limited opportunities for partnership with local entities including university-utility collaborative partnership to promote academia research, partnership with national laboratories or opportunities for utility companies to conduct R&D on site.

Opportunities for Mitigation

The scientific research and development services could be supported by Holtec's work during the decommissioning process. Holtec should look for opportunities to do research in partnership with universities or national laboratories. Holtec should look to repurpose or donate reactor equipment whenever possible.

Consultant, Management, and Office Support Services

Key Takeaways

Consulting, management, and office support services associated with routine company activities will be impacted. The largest impact will be in "All Other Professional, Scientific, and Technical Services."

Although there will be impacts from the loss of the operation of the PNPP, the plant will not be fully closed until the decommissioning process is complete. This is not anticipated until the 2030s-2040s (in 10-20 years). In the meantime, scaled back operations will continue with consulting, management, and office support services may still be required. Likely, there will be a decrease in the marketing research and public opinion polling that PNPP had done in the past. However, other sub-industries may still be utilized by Holtec in a scaled back capacity.

Opportunities for Mitigation

The future site user should continue to work with local consulting, management, and office support services if another opportunity for land management is found.

Source: Aerial view of the Consumers Power Company of Michigan's Palisades Plant Unit 1, Photo from Energy.gov, Accessed: June 28, 2023, en.wikipedia.org/wiki/Palisades_Nuclear_Generating_Station#/media/File:HD.6B.285_(11842463663).jpg

PNPP circa 1974

5.2 OTHER ANTICIPATED IMPACTS ON INDUSTRIES AND SYSTEMS

Demographic Changes

Key Takeaways

PNPP employees will likely find other employment which could lead to longer commutes or entire families migrating away.[199]

Additionally, if a considerable number of jobs are lost by the PNPP closure, young people seeking careers may look elsewhere.

The combination of decreasing income levels from job loss and population loss from the area may impact Van Buren and Berrien County the most. If this becomes a significant trend it could lead to a decrease in property values and property tax revenue.

Opportunities for Mitigation

Demographic changes will likely occur slowly through and past the decommissioning timeline.[200] This slow change provides the time and ability to act on mitigation strategies.

Mitigation strategies should focus on diversifying the size of new housing stock and diversifying the cost of housing. Introducing Missing Middle housing could help to achieve this.

Additionally, Van Buren and Berrien Counties should work to increase the attractiveness of the area by supporting new job production, revitalization, and community development projects, and supporting education programs.

Safety Requirements and Implications

Key Takeaways

Required safety regulations will reduce with the decommissioning process, due to reduced risk to the public when the radioactive materials are cooled and stored. Local authorities will lose funding in the area around PNPP but are still alert to PNPP and will continue to monitor for risks.

The Nuclear Regulatory Commission (NRC) is responsible for safety guidelines and has extensive decommissioning rules and regulations that Holtec and local authorities are following. They will also conduct multiple inspections throughout the decommissioning process.

Housing

Key Takeaways

The impacts of the PNPP closure on housing will likely not be immediately noticeable and may happen over a long period. They will also be diluted because the impact will be spread out in the larger southwest Michigan region from which the PNPP employees commute.

The median cost of a home was not particularly high compared to the state of Michigan. However, ownership of homes within the Tri-County area is made up of mainly higher-income households. This is coupled with rising demand for rental housing, especially for affordable rental units. Therefore, it is likely that the median household cost could reflect the high number of very low-priced homes that may not be desirable. This leads to a cycle of renters paying greater than preferable amounts of their income on rent due to a lack of available options. At the same time, renters likely lose out on opportunities for wealth accumulation that could have led to homeownership. And there was likely a significant shortage of units for both renters and those seeking affordable homeownership.

Additionally, approximately 10-20% of the total housing stock are secondary homes.[201] The impact of the significant prevalence of second homes coupled with low affordable housing availability presents a housing deficit which may exacerbate the areas available and affordable housing units.

If there are a significant number of households that move away and job loss, it could lead to a decrease in property values and property tax revenue.

Opportunities for Mitigation

It is important that the recovery strategy document the impacts and include measures to address these housing challenges as part of the overall regional recovery strategy.

To mitigate the impacts on housing, the Tri-County area could diversify the housing stock to increase overall affordability. This could be done with more flexible zoning and allowing for Missing Middle housing developments. Missing Middle Housing is a range of buildings that include multiple units, such as triplexes or townhomes.[202] Missing Middle development can also contribute to the affordability of the rental units available.

Additionally, there should be support for affordable rental housing units and the overall rental housing stocks. This can be accomplished by reducing zoning restrictions, updating the Low Income Housing Tax Credit program when properties expire from the program (6.2 Low-Income Housing Tax Credit Properties), and/or supporting landlords with subsidies to renovate old or blighted properties. Affordable rental housing is essential for attracting and sustaining the existing working-class households and younger populations who may not have built up the capital to invest in ownership or may not desire a large home.

The southwest Michigan region has struggled with the lack of internet access, particularly in inland rural areas. Internet access is essential for attracting students, entrepreneurship, expanding current businesses, and new housing development. Additionally, the lack of internet access has affected housing sales and

development.[203] Technology Action Plans that have been prepared by Connect Michigan and The Broadband Committee for each of the Tri-Counties.[204] Continuing these efforts will help promote entrepreneurship, attract businesses, and support virtual work.

There is a considerable proportion of students that leave for college or other job opportunities outside of the Tri-County area. Offering educational and career attainments such as apprenticeships are great opportunities for young adults to build up experience and work at the same time. Employers and businesses could additionally benefit from this by filling in work needs.

Source: Covert Townshop Housing, Photo from Lake Michigan Realty, Accessed June 28, 2023, www.realtor.com/realestateandhomes-detail/73064-34th-Ave_Covert_MI_49043_M33885-78039

Tax Impacts

Key Takeaways

The advanced notice of PNPP closure, and subsequent decommissioning timeline, has aided local government's ability to plan and adapt to the loss of property tax revenue.

Van Buren Intermediate School District and Covert Township local government and special districts will face challenging impacts due to the decrease in property tax revenue.

The full impact on tax revenue throughout the decommissioning process will depend largely on how the plant is taxed and assessed throughout the process.

The full impact on Covert Public School District remains unknown at the time of the assessment.

Opportunities for Mitigation

Agile leadership is essential to navigate complex structural constraints.[205] Local governments have raised millages and used voted millages to offset state revenue-sharing reductions.[206] Communities often raise local tax rates to compensate for shortfalls.[207] However, it could also hinder the local government's efforts to attract new businesses. A balanced fiscal policy approach is also essential to manage fiscal risks.[208] This approach requires tools to address legacy costs, intergovernmental cooperation, overall efficiency, and a stable revenue base at the local level.[209]

Local governments interested in renewable energy or clean vehicles should apply for federal tax credits to offset costs. The Inflation Reduction Act (IRA) of 2022 introduced energy-related asset categories that receive direct subsidies. This lets certain local governments receive cash subsidies through direct pay tax credits.[210]

Environment

Key Takeaways

From a regulatory perspective, there were no large environmental concerns or implications at the time of the Economic Assessment or within the next 10 years. Continuous environmental monitoring is necessary to minimize the potential negative impacts. This monitoring is currently implemented and remains from when the plant was operational and includes water, air, dairy, and direct monitoring. The local's largest environmental concern is continuous storage and eventual decision to leave or remove the radioactive material. Holtec and the NRC will make this decision.

Opportunities for Mitigation

There is a need for continued environmental monitoring in order to mitigate potential environmental impacts.

Holtec's continued engagement with the Nuclear Regulatory Commission is necessary to participate in a long term solution for radioactive waste management.

Environmental Justice

Key Takeaways

Several environmental justice factors should be considered due to the inherent risks of nuclear energy and the socioeconomic and demographic makeup of many of the areas surrounding PNPP. However, there were no identified environmental injustices concerns related to the plant at the time of the assessment.

During the assessment VBC, Covert Township, Hartford, Bangor, and Lawrence, were all areas of concern due to their higher level of marginalized residents compared to the rest of the county and state of Michigan. Risks will continue to decrease as the fuel is cooled during the decommissioning process. There were community concerns about waste storage and transportation of waste in the future, but these were safely regulated and are unlikely to cause any harm.

According to the MIEJScreen, the 3 census tracts closest to PNPP have an overall environmental justice score above the 59th percentile.[211] This is based on several indicators under environmental exposure, environmental effects, sensitive populations, and socioeconomic factors. This means that these areas are at a higher risk of environmental injustices (of any kind) than over 59% of Michigan.

Opportunities for Mitigation

There should be additional and intentional engagement with communities around PNPP, especially by Holtec and the NRC. This should include education about nuclear power and transparency with all community members. It is particularly important to include marginalized community members closest to the plant.

6 APPENDIX

6.1 IMPLAN DISCLAIMER

IMPLAN is a regional economic analysis software application that is designed to estimate the impact or ripple effect (specifically backward linkages) of a given economic activity within a specific geographic area through the implementation of its Input-Output model. Studies, results, and reports that rely on IMPLAN data or applications are limited by the researcher's assumptions concerning the subject or event being modeled. Studies such as this one are in no way endorsed or verified by IMPLAN Group, LLC unless otherwise stated by a representative of IMPLAN.

IMPLAN provides the estimated Indirect and Induced Effects of the given economic activity as defined by the user's inputs. Some Direct Effects may be estimated by IMPLAN when such information is not specified by the user. While IMPLAN is an excellent tool for its designed purposes, it is the responsibility of analysts using IMPLAN to be sure inputs are defined appropriately and to be aware of the following assumptions within any I-O Model:

- Constant returns to scale
- No supply constraints
- Fixed input structure
- Industry technology assumption
- Constant byproducts coefficients
- The model is static

By design, the following key limitations apply to Input-Output Models such as IMPLAN and should be considered by analysts using the tool:

- Feasibility: The assumption that there are no supply constraints and there is fixed input structure means that even if input resources required are scarce, IMPLAN will assume it will still only require the same portion of production value to acquire that input, unless otherwise specified by the user. The assumption of no supply constraints also applies to human resources, so there is assumed to be no constraint on the talent pool from which a business or organization can draw. Analysts should evaluate the logistical feasibility of a business outside of IMPLAN. Similarly, IMPLAN cannot determine whether a given business venture being analyzed will be financially successful.
- Backward-linked and Static model: I-O models do not account for forward linkages, nor do I-O models account for offsetting effects such as cannibalization of other existing businesses, diverting funds used for the project from other potential or existing projects, etc. It falls upon the analyst to take such possible countervailing or offsetting effects into account or to note the omission of such possible effects from the analysis.
- Like the model, prices are also static: Price changes cannot be modeled in IMPLAN directly; instead, the final demand effects of a price change must be estimated by the analyst before modeling them in IMPLAN to estimate the additional economic impacts of such changes.[212]

6.2 LIGHTCAST TERMS OF SERVICE

The reports and forecasts in Lightcast Apps and Licensed Datasets are created using proprietary analytical processes applied to data from public, proprietary, and government data sources. Lightcast uses estimates when there are suppressed or missing data points, and such estimates are subject to error. Data, reports, and forecasts included in Lightcast Apps and Licensed Datasets may differ significantly from actual circumstances or outcomes. In addition, Lightcast cannot make any representation of the completeness of data aggregated from any source.

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Lightcast's liability for damages to licensee shall not exceed the amount licensee paid to Lightcast for the product or service in question.[213]

6.3 LOW INCOME HOUSING TAX CREDIT PROPERTIES

In Cass County, there were approximately 324 LIHTC subsidized rental units, spread out across seven different properties, with four of these properties located in Dowagiac. Three of these properties have already reached year 30, with 83 units, and may no longer be operating as affordable rental units. The remainder of the properties will not reach year 30 until at least 2027. for at least 5 years.

In Berrien County, there were approximately 22 properties operating through LIHTC subsidies, which include 1669 affordable rental units. None of these 22 properties have yet reached year 30 and can be assumed to be continually operating through the LIHTC rental requirements. The majority of these programs will not be reaching year 30 until at least 2032, for the next 10 years.

Affordable housing developments in rural areas, including those using LIHTC, greatly benefit from utilizing complementary programs such as Section 515 Rural Rental Housing Loans (Section 515) and the HOME Investment Partnership Program (HOME). Section 515 provides developers with very low-interest loans for the construction or rehabilitation of affordable rental housing. HOME helps to finance affordable housing development by providing grants to states and local governments. Both of these programs, as well as the LIHTC program itself, face an uncertain future as the funding allotted to these programs has dropped in recent years. While it is difficult to predict the future funding amounts, it is important that VBC works to partner with innovative developers who are able to utilize the programs to help bring additional affordable housing to the County.

Housing Voucher Properties:

- Park Meadows (South Haven, MI) - 15 Units (5-1BR, 7-2BR, 3-3BR)
- Village Commons (Lawton, MI) - 6 Units (1-1BR, 5-2BR)

Section 8 Vouchers by Housing Commission in VBC:

- Paw Paw Housing Commission

6.4 LITERATURE REVIEW

6.4.1 SUMMARY OF ANALYSES

By evaluating the nuclear plant decommissioning reports for six different nuclear plant closures, this report summarized the data collection process and methodology for the economic impact analyses and environmental impact analyses of these sites. This information helped guide the analysis process of the PNPP decommissioning. The summaries of the data collection process and methodology of analyses from the six sites are discussed.

6.4.2 ECONOMIC ANALYSES

Data Collection

Data collection methods varied across reports. Southern California Edison provided Beacon Economics with information on expenditures for the decommissioning of the San Onofre nuclear generating station from 2013 to 2026 for the counties of San Diego, Orange, Los Angeles, Riverside, and San Bernardino, the rest of the state of California, and in areas of the US outside of CA.[214] Similarly Entergy and Northstar both provided expenditure data for the economic analysis of the decommission of the Vermont Yankee Plant conducted by the Brattle Group.[215] Other reports did not disclose where their data was sourced from.

Methodology

Several of the reports use IMPLAN to estimate the direct, indirect, and induced effects of a nuclear plant closure on employment, output, wages and earnings, and tax effects. Specifically, when evaluating the impacts of the decommissioning of San Onofre Nuclear Generating Station (SONGS) Units 2 and 3, Beacon Economics used changes in expenditure data to understand how employment and household spending patterns changed and then looked at the effects on all industries impacted, with a distinction between changes in low-wage versus high-wage workers.[216] This report also noted that IMPLAN's estimates may not be able to capture some of the state and local tax changes depending on the state's tax policies.

Through an input-output analysis, Beacon Economics also looked at the impacts on four different counties.[217] It analyzed the individual direct, indirect, and induced impacts using IMPLAN, and also looked at where the concentration of the spending would take place. Additionally, the report used the economic impact multiplier from IMPLAN to justify why the changes are not proportional across counties based on changes in expenditure. Similarly, the report analyzed the impacts on state and local tax revenue by looking at the results from IMPLAN and understanding them through a lens of different intensities of the labor market in individual county economies which are important because of the effect on personal income taxes. Similarly, a report by University of Massachusetts Donahue Institute evaluating the impact of the closure of the Vermont Yankee Nuclear Power Plant used IMPLAN to estimate the economic effects of the closure of the Tri-County region in Vermont, New Hampshire, and Massachusetts.[218] This report also used a change in expenditure to estimate the direct, indirect, and induced economic impacts, specifically looking

at employment, labor income, value added, and output in 3 different time periods of the decommissioning process. However, this report also included trends in the economy, including trends in jobs, income, unemployment, and population, to better understand the context in which the plant closure took place.

Other reports did not use IMPLAN nor any input-output analysis. The Brattle Group, when analyzing the economic impacts of two different approaches of decommissioning, used Regional Economic Models, Inc. Policy Insight model (REMI) to estimate the effects of policy intervention on the decommissioning process.[219] REMI is a type of input-output economic forecasting and policy analysis model and was used to estimate the effects of the plant's decommissioning on employment, wages, GDP, and gross economic output. This report also included results undiscounted, discounted at a 3 percent rate, and discounted at a 7 percent rate. These results were evaluated at a state-level. One analysis of the decommissioning of Crystal River Unit 3 gave expected socioeconomics based on the overall decrease in plant staff, and resulting lost wages and revenue available to support the local economy and tax authorities.[220] This analysis had no empirical data.

One report analyzed the economic impact of Florida Light and Power's nuclear plants in their operational state, as opposed to the impact of the decommissioning process.[221] This report was included because it utilized IMPLAN to conduct the analysis. Like other reports that used IMPLAN, it used expenditures to estimate the direct, indirect, and induced effects on output, labor income, and employment at a local, state, and national level. For the purpose of this report, only their local analysis was considered.[222] In their local economic analysis, they used output multipliers to understand the different plant's impacts on the county in which they operate. Notably, they found a large impact on "imputed rental activity" that measures how the plant's operation affects home value due to increased labor. They also highlighted the sectors that were most impacted by the nuclear power plants.

6.4.3 ENVIRONMENTAL ALALYSES

Methodology

Not every report conducted an environmental analysis of the decommissioning of the relevant nuclear plant.[223] Other reports utilized previous reports on the environmental impact assessment of nuclear plant decommissioning to estimate the effects in their distinct scenario. This occurred when the plant was small enough that an environmental impact assessment was not required and no unique site-specific features or unique aspects of the planned decommissioning were identified. In the instance of the San Onofre Nuclear Generating Station (SONGS) closure, the "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors Final Report" was referenced.[224] This report was used to evaluate the impact of the decommissioning of the Crystal River Unit 3 Plant on the following environmental issues: Water Use, Water Quality, Air Quality, Aquatic Ecology, Terrestrial Ecology, Threatened and Endangered Species, Radiological (Occupational Dose and Public Dose), Radiological Accidents, and Occupational Issues.[225] Similarly, the report by the NRC on the decommissioning of the Pilgrim Nuclear Power Station used the "NUREG, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors" reports and evaluate the topics environmental issues previously noted in the SONGS report.[226]

6.4.4 CONCLUSION

The reports analyzed gave a preface of what information to look for as well as what information would be beneficial to include in the report. Additionally, it guided to what extent IMPLAN data could be used given the data available. However, most of the analyses include expenditures as a positive flow of money into the community received during the decommissioning process, while the analysis looks at the negative change in expenditures as a result of the plant closure. For example, the report on SONGS considers the cost of decommissioning disaggregated into industries where that cost occurs (e.g. waste management; see San Onofre Nuclear Generating Station (SONGS) Units 2 and 3) and the complementary increase in jobs. The discounted rates used in the SONGS report is useful for a full economic analysis.

The approach to the analysis is most similar to UMDI Vermont Yankee Report in its use of IMPLAN.[227] Furthermore, the Diablo Canyon Nuclear Power Plant: Economic Impact Assessment appears to be the most comprehensive and similar to EGI's analytical approach. The findings obtained align reasonably well with those presented in the aforementioned report.[228]

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